73 AMATEUR RADIO

International Edition

NOVEMBER 1989
ISSUE #350
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A WGE Publication

Home-Brew IV Contest W[illegible]

80m rig from a $7 AM radio!
Versatile digital circuit tester
AF meter for misers

73 Reviews:

Instant Track deluxe sat tracker
Yaesu VHF—microwave scanner
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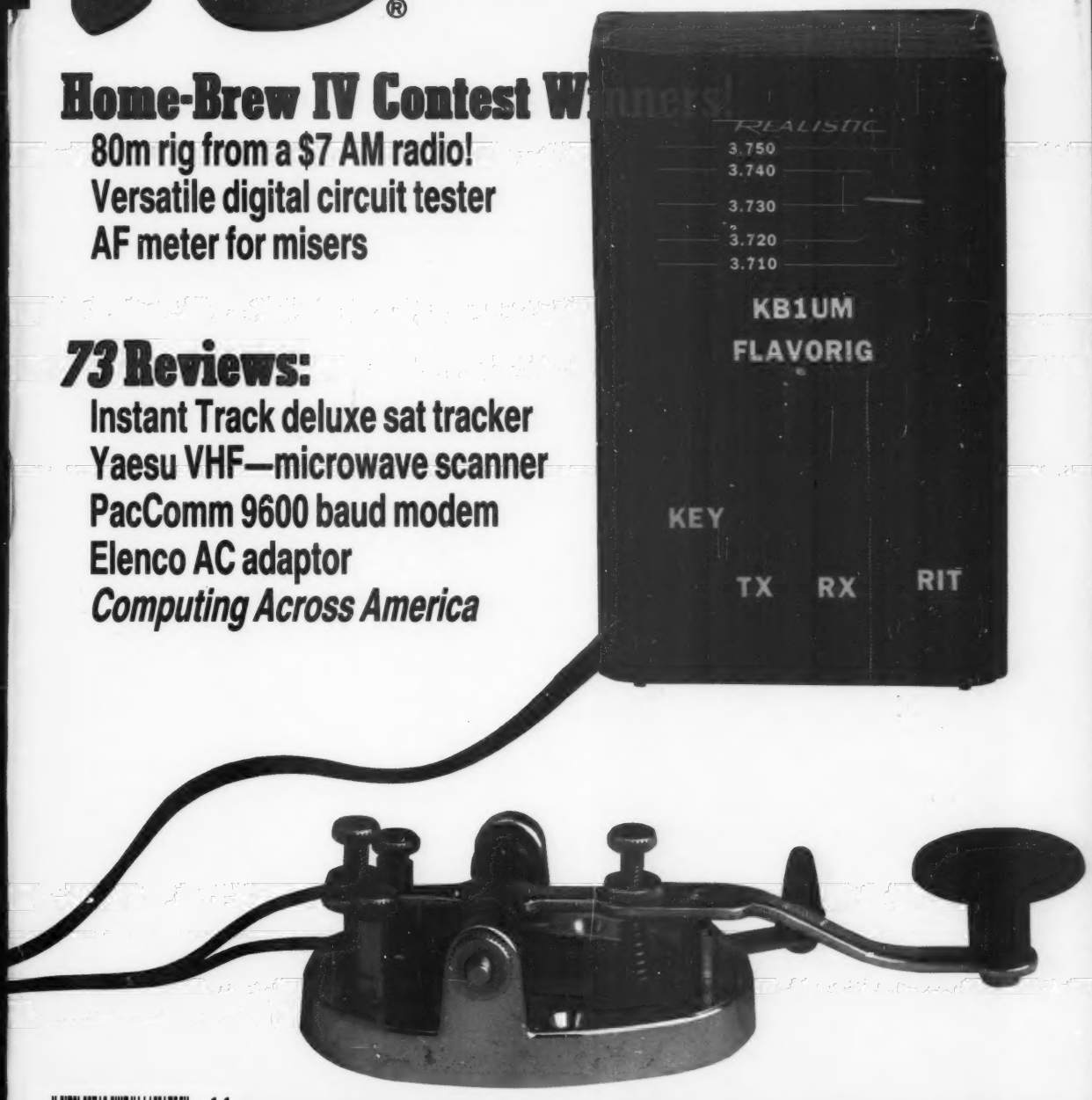
Elenco AC adaptor
Computing Across America



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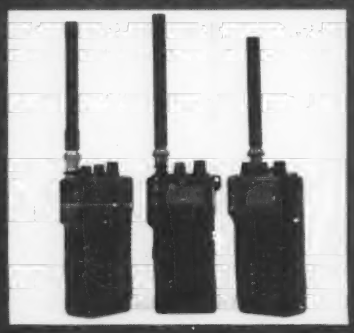

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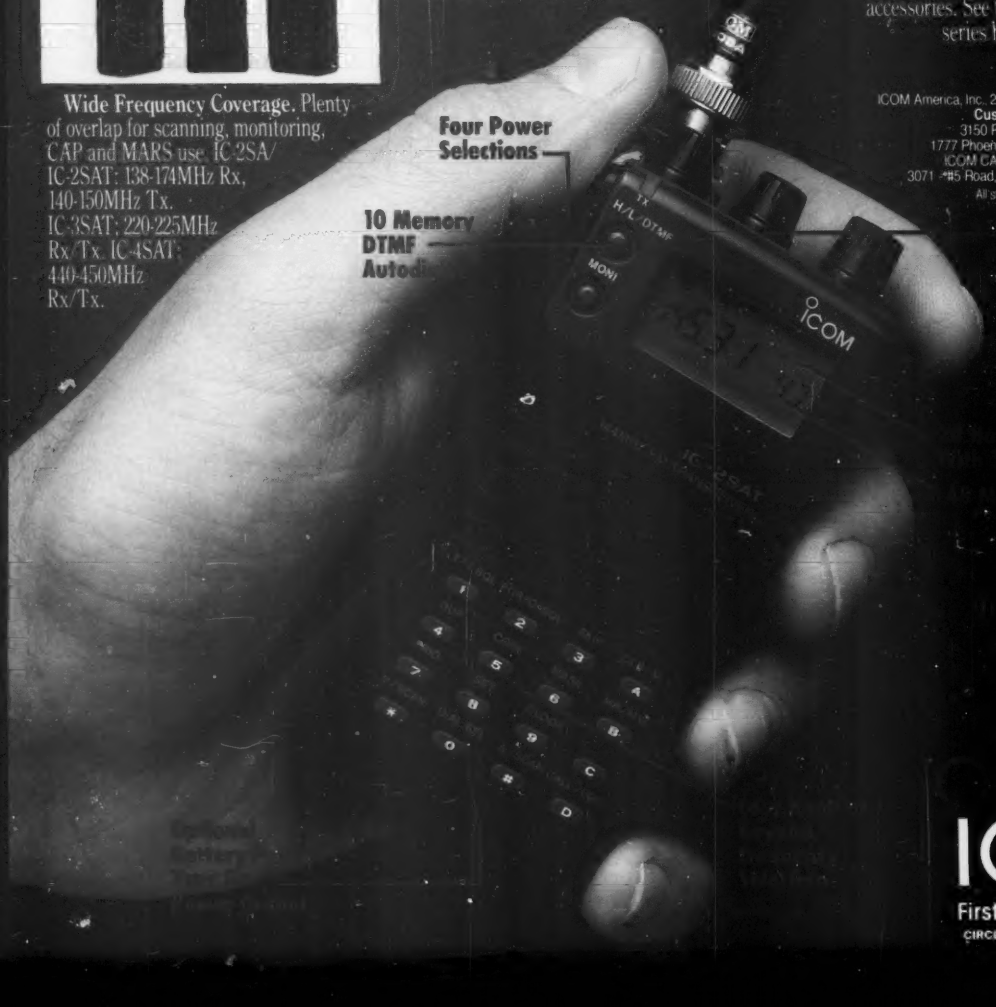

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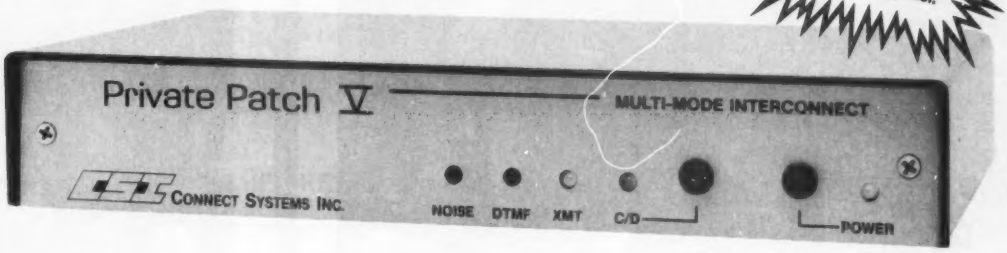

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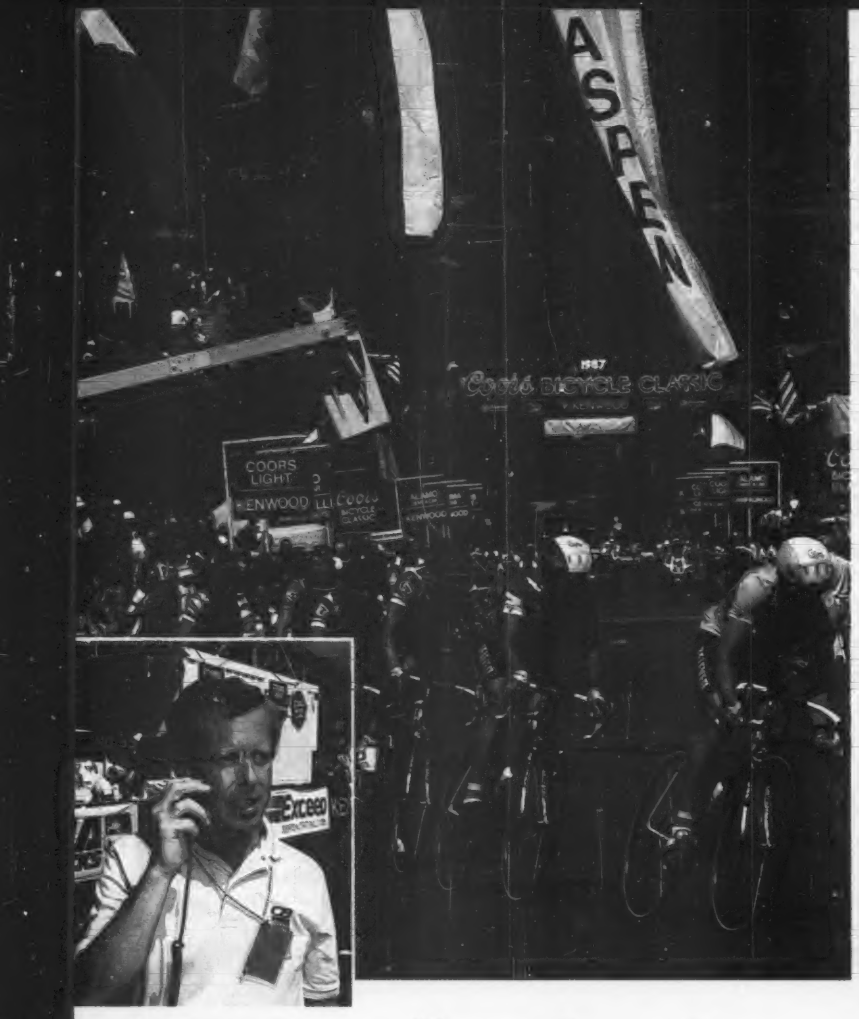

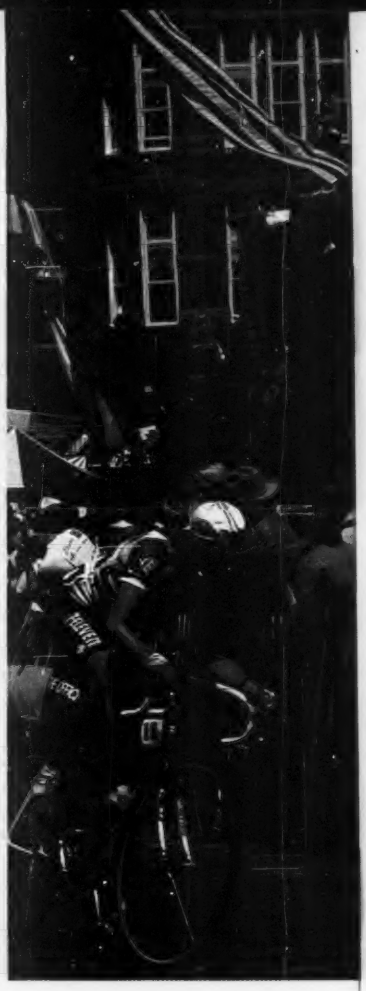

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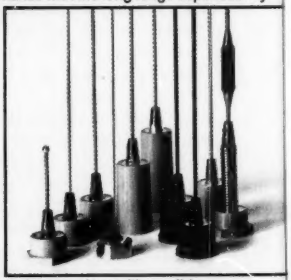

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Cover by Alice Scofield
Cover Photo: Flavorig! (see page 12)

See page 17 for more on Nickol KB2GGW.

WELCOME NEWCOMERS

Books for Newcomers

Uncle Wayne's Bookshelf offers some great books for beginners, and I want to share my favorites with you. From time to time, we receive letters from readers complaining that we have little to offer newcomers, or that they don't know where to begin to learn about amateur radio. Usually I copy the *Bookshelf* from the most recent issue of *73*, circle my favorites, and send it to the inquirer. In this *Welcome Newcomers*, I thought I'd go a step further and let you know *why* they're my favorites.

Can It Really Be That Cosmic?

Tune in the World with Ham Radio, an **ARRL** publication, is a good place to start. It's easy to read, well-organized, and visually stimulating—especially the cover of the 7th edition. A translucent road unravels through the galaxy, disappearing into what looks like the Crab Nebula. A couple of novae peer out at you from the depths of space, while a shiny, flying transceiver swoops through a rift in spacetime, darting off at an angle, its top glinting with stardust. A glowing earth nestles inside the chassis, behind the dials.

This 222-page, 8½"x11" book contains everything you need to know to pass your **Novice Class** written exam, and more. But not too much more, just enough to give you some background. It opens with a chapter on ham activities, **OSCAR** history, and the diversity of the ham community. The next chapter outlines basic operating procedures, the kinds of licenses and their privileges, the ethics of the Amateur Radio Service, and **FCC** rules.

Three chapters totalling 26 pages introduce you to electrical theory, electronics, parts, and circuits. This includes photos, sidebars highlighted in blue, and diagrams. The few important equations you need to know are easy to spot.

The next three chapters cover hardware. What do you look for in equipment? What do all the knobs, dials, and switches do? What kind of antenna do you need, and should you make your own?

One chapter is devoted to getting on the air. It has tables of **Q-signals**, correct **CW** procedures, widely used CW abbreviations, the **RST** system, and much more in just twenty pages. The last couple of chapters deal with **packet**, Novice privileges, modes of communication, and troubleshooting common problems. The complete question pool for the Novice license exam, Element 2, is in the back of the book, along with the answers.

I like this book because the writing style is simple and direct, the layout emphasizes the essential, a handy key word glossary is at the beginning of each chapter, and helpful tables and diagrams are at the back of the book. Price, $12; with code practice tapes, $15.

More General Coverage

The Beginner's Handbook of Amateur Radio, by Clay Laster W5ZPV, is another winner. My hands get warm just holding this inch-thick, 8¼"x5", 418-page volume. Although it's easy for the beginner to read, it's meaty and nourishing.

It contains basically the same information as *Tune In*, but it's organized differently. Technically, it's slightly more detailed, and sample test questions are scattered throughout the book. The style is clear and direct, but not dry. Price, $16.95.

For a dollar, you can get a little ARRL booklet titled *Operating an Amateur Radio Station*. It packs a lot in 42 pages.

Reaching for the Sky

Should you buy or make your first antenna? What kind of antenna should you use, vertical or dipole? Can you convert Uncle Charlie's old 27 MHz CB antenna to 10 meters?

Easy-Up Antennas for Radio Listeners and Hams, by Edward M. Noll (8½"x11", 158 pages), can give you a lot of ideas. It offers precise dimensions, neat diagrams, and just the right dose of theory.

For the Novice, it explains how to make a vertical for 15 meter **DXing**, a 40m sloper, a 2-element 15m inverted-V beam, a 10m elevated vertical, a 2-band inverted dipole, a tuner and 15/40m dipole, a random-wire with tuner, and 1¼m VHF antennas.

Several chapters apply to all types of antennas, and the author instructs you to read these before you begin construction. There is a special chapter for Technician and VHF/UHF antennas, and another for General and Advanced Class operation. The Appendix lists manufacturers and sources of information.

The beauty of this book is that while it's easy for beginners to understand and use, it's also a practical resource for experienced hams. Price, $16.95.

Doug DeMaw W1FB's **Novice Antenna Notebook** is full of ideas, tips, and knowledge gained from years of experience. I would recommend both of these books for the beginner, and I can't really say which one you should buy first. 8½"x11", 124 pages. Price, $8.

What's All the Packet Racket About?

You've probably heard that **packet**, a system of **digital communications**, is the new frontier of amateur radio. To find out what it's all about, I recommend **Your Gateway to Packet Radio,** by Stan Horzepa WA1LOU. It's 8½"x5, 207 pages. Price, $10.

Or you may prefer *The Packet Radio Handbook*, by Jonathan L. Mayo KR3T, or *Mastering Packet Radio*, by Dave Ingram KA1WJ. As to content, both of these books look just as good as *Gateway*, but I prefer the latter because of the inclusion of tables and other references at the end of the book as appendixes.

For an overview of digital communications modes, try **The Digital Novice,** by Jim Grubbs K9EI. Size, 8¼"x5", 128 pages. Price, $8.95.

Beginning Construction

One Evening Electronics Projects, by Calvin R. Graf and Richard S. Goss, is excellent. After describing each of the 16 projects, the authors provide construction tips. Each project merits a full chapter. 7¼"x9½", 174 pages. Price, $8.95.

Hints & Kinks for the Radio Amateur, 8½x11", 130 pages, is full of "practical ideas from the pages of *QST*," as the publisher claims. Modifications, tips, information on the quirks of specific equipment, updates, and improvements make this book not only useful, but enjoyable for browsing. Price, $5.

CW—Do It Just for Fun

The third chapter of *Tune In* gives some good advice on learning code, and directions for building a code-practice oscillator. ARRL code tapes come with this book as a kit. Check Uncle Wayne's Bookshelf for postal rates and more information. W5ZPV, in *The Handbook*, also devotes a few pages to learning and practicing code. GGTE's Morse Tutor ($19.95), and our 5 and 6+ wpm code tapes, "Genesis" and "The Stickler," are excellent ($5.95 each).

Everyone has advice about learning code. Mine is this: Just play with it, for fun, as you would a video game. Second, don't worry about how long it takes. Just do it every day for about twenty minutes. Third, if possible, don't take the test until you're really comfortable copying at about 7 wpm. Then, on test day, you probably won't have to worry about whether you'll pass or not; you can be pretty sure you will. . .de Linda KA1UKM

GLOSSARY

ARRL American Radio Relay League.

CW Morse code. Code is produced by interrupting a *continuous wave* signal with "dits" and "dahs."

Digital Communications Information designed to be received and printed automatically; transmissions used for the direct transfer of information from one computer to another; data in binary code (on/off, "1", "0").

DXing Long distance hamming, especially contacting foreign countries.

FCC Federal Communications Commission.

Novice Class license The most basic amateur radio operator's license class. You can upgrade from Novice to Technician, General, Advanced, and, finally, to Extra.

OSCAR Orbiting Satellite Carrying Amateur Radio.

Packet A system of digital communication where information is broken into short bursts containing addressing and error-detection information.

Q-signals Three-letter groups which facilitate CW communication, such as "QTH" for "location."

RST A standard system of reporting *readibility, strength, and tone* of a contact.

MFJ's *new* ham license upgrade Theory Tutor

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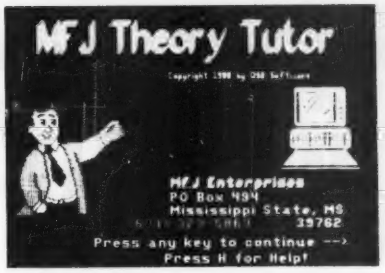

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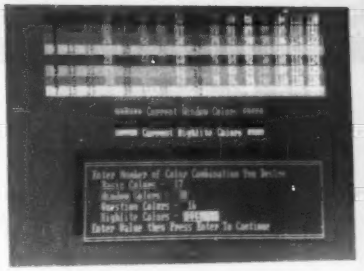

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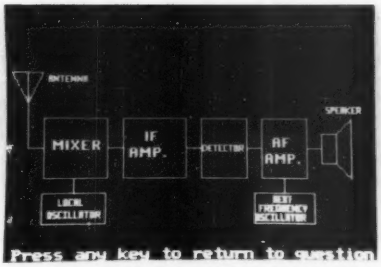

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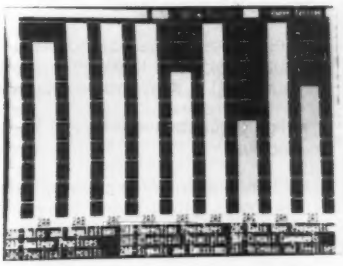

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- The TM-3530A is a 25 watt version covering 220-225 MHz. The first full featured 220 MHz rig!

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Compatible with Kenwood's DCS (Digital Code Squelch), the DCL system enables your rig to **automatically** QSY to an open channel. Now you can automatically switch over to a simplex channel after repeater contact! Here's how it works:

The DCL system searches for an open channel, remembers it, returns to the original frequency and transmits control information to another DCL-equipped station that switches **both** radios to the open channel. Microprocessor control assures fast and reliable operation. The whole process happens in an instant!

Actual size front panel

Optional Accessories

- **TU-7** 38-tone CTCSS encoder
- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply for TM-2550A/2530A/3530A
- **PS-50** DC power supply for TM-2570A
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48B** extra DTMF mic. with UP/DWN switch
- **MC-43S** UP/DWN mic.
- **MC-55** (8-pin) mobile mic. with time-out timer
- **SP-41** compact mobile speaker
- **SP-50B** mobile speaker
- **SWT-1** 2m antenna tuner

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications and prices are subject to change without notice or obligation.
Specifications guaranteed on Amateur bands only.

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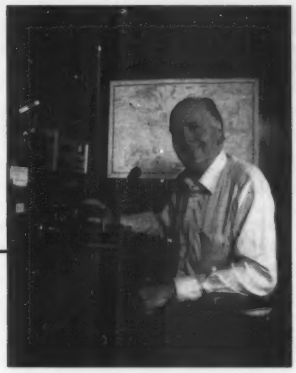
Wayne Green W2NSD/1



How To Attract Youngsters

A letter from a reader described the ham radio display at the recent Canadian National Exhibition. Alas, apparently those in charge hadn't read my editorials. The display was almost entirely involved with how difficult it is to get a ham license, with not a hint to the visitors of how much fun they might have if they joined us.

There was a big sign listing what subjects are on the license test, a sample study guide, details on rules and regulations, a Morse Code key, a sample license, info about signing up for classes . . . and, wow, a world globe. Was there even a hint to explain why anyone should bother to go to all this trouble? Nope.

I'm sure the Canadians involved will opt to shoot the messenger and get mad at me for saying anything, instead of making sure that any future efforts to interest youngsters in amateur radio are better conceived.

I just wonder if you might not do exactly the same thing, were you in their shoes. I've never seen a good ham radio display aimed at the general public. Most of 'em are like the ARRL Ham's Wide World videos—largely self-congratulatory, with almost zero sales effort.

Give it a try. Can you come up with anything you might tell youngsters to try and get them interested in hamming? Would you start right in explaining the details of how to get a license or would you do a little selling of the sizzle first? If so, what would you say?

The above gave me a great idea on a new way to sell amateur radio to newcomers. Presuming that sometime in your ham career you've had some fun, the first step is for you to see if you can remember what you did that was fun. Any luck with that?

Now, amateur radio, being largely an audio hobby—except perhaps for home construction, slow scan and certificate hunting—how about our putting together an audio cassette with an illustrated sales message about amateur radio? Do you think, if we all work together on this, that we can come up with an hour tape which will demonstrate how much fun we're having with amateur radio?

If you'll record the needed sound bites, I'll add an enthusiastic sales pitch on our hobby and make the cassette available for sale at future ham displays, expos, malls and so on. It'll be something both to help sell amateur radio and to get the kids to come to classes, as well as a way to offset some of the expense of exhibits.

Can you come up with 30-second to three-minute sound bites which illustrate how much fun you're having with amateur radio? Put some new batteries in your cassette recorder and let's see what you can do. Yes, of course I'll give credit for the individuals or clubs that come up with usable sound bites.

Can you break the ice and get a rare DX operator to tell you something interesting about his country, while talking so an untrained listener can understand what's being said?

I'll see if I can get King Hussein to say a few words about how much amateur radio has meant to him—and to Jordan. And I'll bet we can get Barry Goldwater to tell an interesting story about a ham contact.

We should have a lot of aurora this winter, so be sure to send me some 2m aurora CW contacts. What can you do for me in an unusual repeater contact? Anything like the one I had almost twenty years ago from my HT on a street corner in Las Vegas in a round table with Phoenix, San Diego and San Francisco? I expect not . . . surprise me.

No, I don't think I need any tapes of Los Angeles repeaters. Thanks, anyway.

I wonder if I can find my old tape of G2PU calling CQ on 75m one afternoon, boiling through on the East Coast? Well, that was exciting for me, but I doubt a youngster would appreciate it. Never mind.

Yes, I'll have a booklet with the tape so we can show slow scan pictures, an inexpensive modern computerized Morse/RTTY/packet station, some simple antennas, a flea market, a typical low cost ham station, an HT, a drawing of how a repeater system works, a tiny homemade QRP rig, a direction finding antenna . . . things like that. But the key to the whole works will be the tape—and you've got to do the leg work for that. You give me the material to work with and I'll give you a great sales tape.

I'm going to be watching club newsletters, looking for mention of this project, inciting the members to get busy taping. If all I see is business as usual, is there any reason I shouldn't believe your club could care less about what happens to our hobby?

Once you send your cassettes to *73 Magazine*, Forest Road, Hancock NH 03449, my goal will be to provide a cassette and booklet sales package

wk8n
SPECIAL EVENT

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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which will bring us a flood of new hams and also make a profit for clubs. Please get your tapes in by January 30th at the latest.

Isn't That Odd?

The repeat PBS broadcast of the Nova program on Richard Feynman, the Nobel physicist who died last year of stomach cancer, got me to thinking. Dick's the chap who upset the Morse Commission Challenger disaster investigation by pointing out what happened to the O-rings when they were chilled, a fact the other team members missed. Dick went through life noticing things which didn't quite fit into accepted dogma. Please look for his paperback book, *"Surely You're Joking, Mr. Feynman!"* You won't find a more enjoyable use for $8.95.

For instance, isn't it odd that there are a few people who can do incredible math problems in their heads? Isn't it odd that some people can read printed type in total darkness with their fingers? Isn't it odd that many people are able to sense colors by feel in total darkness? Isn't it odd that almost everyone, no matter their religion, who has a near-death experience, reports essentially the same events? Isn't it odd that some people can communicate mentally, consistently sending long messages with zero errors? Isn't it odd that a few people have been surprisingly successful in seeing future events? Isn't it odd how alike twins can be, even when separated at birth? Isn't it odd that almost everyone, when regressed under hypnosis, can contact past lives?

It's not difficult to find thousands of such anomalies. The easy response is to reject them. Somebody exaggerated or lied, right? Let's throw out tens of thousands of UFO reports too, OK? Throw 'em out even when the people involved pass every test of believability.

A Denver woman was intrigued that leukemia deaths so often seemed to run in bunches. She decided to check it out. She plotted children's leukemia deaths in the area, looking for possible patterns. After visiting dozens of homes and talking with the families, she still didn't see any common factors. Then one day the light dawned. In most of the leukemia homes she visited she'd noticed that they had a high tension power line with a pole transformer on it nearby. The power from this transformer was then fed to other houses down the street—the ones with low cancer levels.

I mentioned this in my September editorial. Oddly enough, the several research projects this study eventually triggered, which have supported the concept that power line magnetic fields appear to be causing serious health problems, particularly for children, have met with only lukewarm media coverage.

If, as the studies seem to indicate, we're getting zapped by power line magnetic field radiation, computer display terminals and electric blankets, what can we do about this mess? First, we obviously should panic. That's always a good first step in any emergency. Then what? If you've got one of those big black pole pigs outside your home, should you start packing? If you're working in a data center with a bunch of video terminals, should you start looking for less hazardous work? And should we all turn off our electric blankets and freeze at night like our grandparents used to? Yes, I know, they used wool blankets—a good interim solution.

It seems to me that buying or building a gaussmeter might be a good investment—not only to make sure that your home and work place were magnetic field free, but perhaps to gauss for your friends. With these very weak fields apparently having enough effect on our cells to help cause cancer, leukemia, birth defects, miscarriages and so on, who needs the aggravation?

So let's say you've built a gaussmeter and you find your worst fears are verified—you and your family are being gaussed! Then what? Before moving I'd want to see if it isn't possible to generate a magnetic field to counter the offending one. A few turns of wire around your home and perhaps ten to twenty watts might well balance out even a fairly strong magnetic field from a nearby power line or transformer. Your gaussmeter will tell you the story.

What about the electric blankets? That's going to be tougher. But now that the cat's out of the bag, if I were an electric blanket manufacturer, I would spend whatever it takes for an engineer to design a self-canceling magnetic field blanket. If they run the heating wires in pairs, their fields should cancel and we'll see a jump in the birth rate—just what we need.

This could be catastrophic for the sickness (which we call "health") community—doctors, hospitals, drug companies, undertakers, cemeteries. It could even upset the Social Security system, since it's possible that magnetic currents are causing more deaths than cigarette smoking.

Hmmm, you know, in the old days they oriented houses so they were facing north or south. People preferred to have their beds on a north-south axis. When you consider that the earth's magnetic field is over 500 times as strong as the 60 Hertz fields which are causing us so many health problems, maybe we should check out how cells fare with different compass orientations. Perhaps there was something to this business of sleeping with your head to the north. Probably not, but why takes chances, right? All I know is that once I changed my bed so my head was to the north, I stopped having serious back problems—and that was 25 years ago.

I'll bet the thousands of you who Bashed your way to a ham ticket are kicking yourselves now. Suddenly your neighbors, who before were slashing your tires in retaliation for TVI, now will be turning to their supposed neighborhood electrical genius for help and you don't know bupkis. Let me know how interested you are in our publishing a series of articles on the fundamentals of alternating current and magnetic fields.

We're getting a milligaussmeter for use around the *73* hamshack, the WGE building, and gaussing out our employee homes. We're calling our new company *Gaussbusters*. If you're interested I'll let you know how we make out.

In the meanwhile, read the Feynman book and enjoy it. Then start looking for anomalies and see where they lead you.

If you're able to come up with a simple degaussing system for video monitors and TV sets, and if you market it right, you'll be set to make a mint. The real entrepreneurs already have a month or two head start on you, so you'd better get cracking.

Birthday

As one gets older a birthday is not just a milestone, it's a time for reflection. It's a time to ponder what's been accomplished so far and what may yet be done. At 67, I'm about ten years older than the average ham, so maybe you'll be interested in my perspective—in what you may be facing ten years from now when your 67th birthday comes around.

Being practical about it, how many more years can I count on to be productive? And then what? Sure, some men manage to stay relatively healthy and sharp into their 80s. But not many. So maybe I can hope I'll be able to get in ten more years before I drop dead. I'm in pretty good health—don't smoke or drink—so I should be able to beat the odds, which are around 72 years these days, by five years.

Ten years. Ain't very much, considering my extravagant goals. You know, I get exasperated when I talk with retired hams on the air, men who have spent a lifetime getting good at something and then walk away from their expertise to fritter away what's left of their lives rag-chewing on 75m and playing golf. Phooey.

I've spent a lifetime getting good at publishing, so naturally some of my goals are in that field. I've got a list of ten magazines I want to start—magazines which are needed and will benefit the country. All are unique concepts.

When I took back the position of publisher of *73*, I did it with the hope that through *73* I might be able to help get amateur radio growing again—to again attract youngsters to the hobby and as a result make sure amateur radio would be around for yet another generation or two. Even more important to me was that I see amateur radio as a major resource for providing America with the very best kinds of engineers, technicians and scientists in an age when technology is the key to world power.

As a technician on a submarine during WWII (hmmm, that was 45 years ago!) I saw up close how technology turned the tide in that war. I recognized that as a metaphor for the coming economic world war, which I believed would be next. International business has replaced guns and bombs, and America is losing WWIII.

It's frustrating to see this happening and be relatively helpless to do much about it. It's even more frustrating when I see how much amateur radio has inadvertently contributed to America's losses in this new kind of undeclared war. I see amateur radio atrophying—and with its decay, nailing the coffin of America's hopes for winning WWIII.

We've already lost our consumer electronics industry. We're well along with losing our entertainment industry, our hotels, and even our computer industry. We've lost much of our automotive and clothing industries. Even our publishing industry is being bought out.

We won't win this economic war by putting our bets on megabusinesses—these are much too easy to buy out, as we've been seeing. America's real strength lies in about seven million small businesses, not our Fortune 500.

You know, we've been so dazzled by our military preoccupation with the USSR, that we haven't been watching our economic store. Japan has been able to quietly lop off key chunks of our business anatomy, one after the other, without our seeming to really notice.

Japan, with a fantastic school radio club infrastructure, is running circles around us in engineers and technicians. We killed our school clubs off 25 years ago, as I seem to keep mentioning, and yet which seems to come as an incredible revelation when I give talks at hamfests.

Now, after about three years of trying to interest amateurs or the ham industry in the problem, I've seen so little progress that I find myself looking for fights which seem more winable. Sure, I know some low cost ways of solving our problems—like getting a hundred ham industry companies to ante up $100 each to fund a National Industry Advisory Committee (NIAC) to go to Washington and meet with the new FCC commissioners to help make them aware of what's happened and our proposals for solving this national technology crisis.

Like getting a pilot program into our public schools to teach the fundamentals of electronics, communications and computers to grades 5–12 via a new teaching system which will eliminate the usual need to take ten years to develop new teachers. This could easily bring us an extra 50,000 new hams a year as a bonus. If we expand the program to every state we might end up with millions of new young hams—and finally have some use for the 99.9% of our bands which are virtually unused—and some impetus to develop very-narrow-band voice systems before the Japanese do it.

My educational plan would have the drawback of costing the federal and state governments nothing, so you know it would be fought to the death by our bureaucracy and legislators.

Ditto my plan for solving the welfare

Continued on page 74

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DX-cellence!

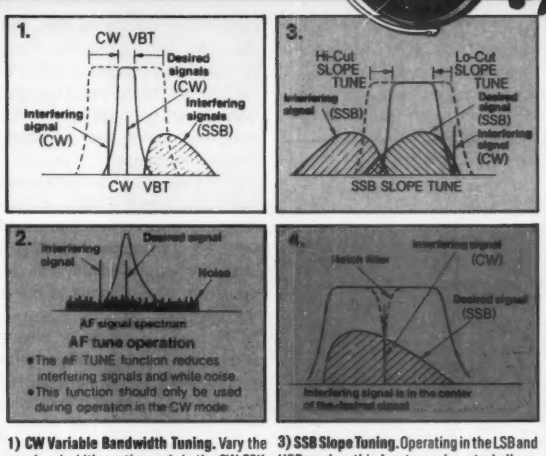
#1 Rated HF!

TS-940S

Competition class HF transceiver

TS-940S—the standard of performance by which all other transceivers are judged. Pushing the state-of-the-art in HF transceiver design and construction, no one has been able to match the TS-940S in performance, value and reliability. The product reviews glow with superlatives, and the field-proven performance shows that the TS-940S is "The Number One Rated HF Transceiver!"

- **100% duty cycle transmitter.** Kenwood specifies transmit duty cycle ***time.*** The TS-940S is guaranteed to operate at full power output for periods ***exceeding one hour.*** (14.250 MHz, CW, 110 watts.) Perfect for RTTY, SSTV, and other long-duration modes.
- **First with a full one-year limited warranty.**
- **Extremely stable phase locked loop (PLL) VFO.** Reference frequency accuracy is measured in ***parts per million!***



1) CW Variable Bandwidth Tuning. Vary the passband width continuously in the CW, FSK, and AM modes, without affecting the center frequency. This effectively minimizes QRM from nearby SSB and CW signals.

2) AF Tune. Enabled with the push of a button, this CW interference fighter inserts a tunable, three pole active filter between the SSB/CW demodulator and the audio amplifier. During CW QSOs, this control can be used to reduce interfering signals and noise, and peaks audio frequency response for optimum CW performance.

3) SSB Slope Tuning. Operating in the LSB and USB modes, this front panel control allows independent, continuously variable adjustment of the high or low frequency slopes of the IF passband. The LCD sub display illustrates the filtering position.

4) IF Notch Filter. The tunable notch filter sharply attenuates interfering signals by as much as 40 dB. As shown here, the interfering signal is reduced, while the desired signal remains unaffected. The notch filter works in all modes except FM.

- **Complete all band, all mode transceiver with general coverage receiver.** Receiver covers 150 kHz-30 MHz. All modes built-in: AM, FM, CW, FSK, LSB, USB.
- **Superb, human engineered front panel layout for the DX-minded or contesting ham.** Large fluorescent tube main display with dimmer; direct keyboard input of frequency; flywheel type main tuning knob with optical encoder mechanism all combine to make the TS-940S a joy to operate.
- **One-touch frequency check (T-F SET) during split operations.**
- **Unique LCD sub display indicates VFO, graphic indication of VBT and SSB Slope tuning, and time.**
- **Simple one step mode changing with CW announcement.**
- **Other vital operating functions.** Selectable semi or full break-in CW (QSK), RIT/XIT, all mode squelch, RF attenuator, filter select switch, selectable AGC, CW variable pitch control, speech processor, and RF power output control, programmable band scan or 40 channel memory scan.

Optional accessories:
• AT-940 full range (160-10m) automatic antenna tuner • SP-940 external speaker with audio filtering • YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filters; YK-88A-1 (6 kHz) AM filter • VS-1 voice synthesizer • SO-1 temperature compensated crystal oscillator • MC-43S UP/DOWN hand mic. • MC-60A, MC-80, MC-85 deluxe base station mics. • PC-1A phone patch • TL-922A linear amplifier • SM-220 station monitor • BS-8 pan display • IF-232C/IF-10B computer interface.

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QRX . . .

EDITED BY BRYAN HASTINGS NS1B

K6MH is New AP!

73 Magazine proudly announces the arrival of its new Associate Publisher, Jim Morrissett K6MH.

Jim brings much amateur radio magazine publishing experience to the post. He first started at *CQ Magazine* as Associate Editor in 1955, when Wayne Green was the editor. Among his interesting tasks there was a trip to Antarctica in late 1956 and early 1957 to serve as a correspondent for *CQ Magazine*. Later, Jim wore many hats on the staff of *73 Magazine* during its tender beginnings in New York City in the early sixties.

Jim will certainly be a vital influence in the continuing growth of *73*. Welcome aboard, and welcome back!

Boldly Go Up-Frequency

You can go ahead and buy that gear for 450 MHz and above—it now looks like there WON'T be retaliatory trade measures taken against UHF amateur gear imported from Japan (see the August '89 "QRX"). The US earlier charged Japan with maintaining unfair trade barriers, particularly in the cellular phone market. Thus, the US Trade Representatives office planned to impose a 100% duty on 70cm and shorter frequency band mobile communications gear from Japan. Japan, however, has now agreed to open up its cellular market to US firms, negating the purpose of the proposed tariff.

Cool It!

The FCC has three new Commissioners. On 4 August, the Senate confirmed the Executive nomination for Sherrie Marshall, Andrew Barrett, and Alfred Sikes. After Commissioner James Quello swore in Sikes, President Bush designated Sikes as FCC Chairman. Since 1986 Sikes has served as Assistant Secretary of Commerce and Administrator of the National Telecommunications and Information Administration at the Department of Commerce.

1¼ meter users had long been worked up about the nomination of Sherrie Marshall as she has spent the past several months as a partner in the law firm that represents United Parcel Service in the 220–222 MHz reallocation issue. Those folks can now redirect their energies. As it turns out, Ms. Marshall was not with the firm at the time it was retained by UPS, nor has Marshall been involved in the 220 MHz reallocation issue! This is likely why the ARRL, which has been leading a "Save 220" campaign, didn't file any opposition to the Marshall nomination.

Here's one of the many fine Japanese amateur club photos that come across our desks at 73 HQ.

This one was snapped during Erik Orre N6PPD/7J4AAG's 10-month sojourn in Shimonoseki, on Honshu, Japan's main island. Here, Eric poses with a few of the club members of the Chamber of Commerce hsm club in the city. N6PPD reports he was treated with the utmost kindness and friendliness during his stay.

So, let's see some more of these from this side of the Pacific! No polaroids please—35mm or better, and color much preferred.

UK Novice

The Radio Society of Great Britain (RSGB) presented its initial proposals for a United Kingdom Novice license level. See the September issue of the Society journal, *Radio Communications*, for details.

VHF/UHF Records Set!

There are four new world VHF/UHF DX records! During 13–15 July, Paul Lieb KH6HME, camping on the Mauna Loa volcano in Hawaii, and Jack Henry XE2GXQ in Baja California, Mexico, broke records for 2m, 1¼m, 70cm, and 13cm amateur contacts. The 2 meter record of 2659 miles was set on July 13 at 10:46 AM HST by Paul, at the Mauna Loa site, in contact with Jack, who is located at Rosarito (about 640 miles south of San Diego). They exchanged a 5 x 2 signal report on SSB. KH6HME was running 80 watts to a pair of 7-element stacked yagis, and the station at XE2GXQ ran 160 watts to a single 18-element "boomer."

They broke the 70cm record the next day, at 3:47 PM HST. The distance was 2573 miles between the two operators. Here, Paul ran 100 watts to an 18-element quagi antenna. A few hours later, this dynamic duo felled the 13cm record! This occurred at 5:54 PM HST, while the 10 watt Hawaiian SSB signal beamed toward the mainland, using four vertically stacked loop yagis.

It took more than a day to break the 1.25m record. Finally, at 7:55 AM HST on 15 July, Jack heard Paul's S-2 FM signal on 223.56 MHz. His radio used only a single 5-element yagi antenna to make the path.

The best conditions for a west coast mainland US to Hawaii path occurred on 14 July, when KH6HME confirmed hearing XE2GXQ, who at the time ran only *one milliwatt* on 144.170 MHz, to make the 2500 mile Pacific path! During the same period, KH6HME also worked numerous other stations from Los Angeles and San Diego.

FAR Scholar Winners

The Foundation for Amateur Radio announced the recipients of 31 scholarships it offered for the 1989–90 academic year. FAR is a non-profit organization representing fifty clubs in Maryland, D.C., and northern Virginia. It is devoted exclusively to the scientific, literary, and educational pursuits that advance the purposes of the Amateur Radio Service.

Winners are: Douglass Claprood KA2KWB, David Hulka KD9UA (two awards), James Weldon N1DFQ, Christopher Glassie AD9Q, Rebecca Beth Knoll N4JST, Robert Popella KA3HIE, Colin Smith KB5BSH, Diane Willeman KE8DJ, Laurie Sandell N2FSO, William Sands KA3FXX, William Baggett AA5DF, Michael Sensor KD3LR, Nathan Willingham KA0UFO, Victoria Gruen KA2VHR, Ross Lepaine WG7I, Jack Porter KC0VX, Amos Faux-Burhans KS3O, Barry Bell KA3PRE, Maurice De Vidts NE3S, David S. Katz N3DKV, Kurt Rupperecht N3EOI, Steven Stewart KB4LUJ, Nathaniel Tarbox KC4ACI, Richard Kordick KE0AS, William Free KC3YO, Douglas Benish N3CXB, Lesley Walker N4FTJ, Douglas Kleeman KA9LWN and David Wright WB9VOZ.

Scholarship applications are open to all amateurs meeting the qualifications and residence requirements of the various award sponsors. To get an application, write to: Foundation for Amateur Radio, 6903 Rhode Island Ave., College Park, MD 20740.

Congratulations to this year's winners!

MORE 1.25m Ham Spectrum?

Endorsement of an entry level code-free amateur license was not the only action taken by the ARRL Board of Directors at their recent meeting. The board also directed its counsel, Chris Imlay N3AKD, to go after new 1¼ meter spectral territory—216–220 MHz—as a secondary status allocation! For this, Imlay will file a Request for Rule Making before the Federal Communications Commission (FCC). Stay tuned here for developments.

Thanks

. . . to *Westlink Report* for contributing to this month's news items. Keep your ham radio-related news items and photos rolling in to *73 Magazine*, WGE Center, Forest Rd., Hancock NH 03449, Attn: QRX. You may also submit text as E-Mail to the Sysop on the 73 BBS, (603) 525–4438, 300/1200 baud, 8 data bits, no parity, and one stop bit.

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All New Dual Bander!

Two in the Hand!

TH-75A

2m/70cm Dual Band HT

The new TH-75A Dual Band HT from Kenwood is here now! Many of the award-winning features in our dual band mobile transceivers are designed into one hand-held package.

- **Dual Watch** function allows you to monitor both bands at the same time.
- **1.5 watts on 2 meters and 70cm: 5 watts when operated on 12 VDC (or PB-8 battery pack).**
- **Large dual multi-function LCD display.**
- **10 memory channels** for each band stores frequency, CTCSS, repeater offset, frequency step information, and reverse. A lithium battery backs up memories. Two memories for "odd split" operation.
- **Selectable full duplex operation.**
- **Extended receiver range:** 141–163.995 and 438–449.995 MHz; transmit on Amateur band only. (Modifiable for MARS and CAP. Permits required. Specifications guaranteed on Amateur bands only.)
- **Uses the same accessories as the TH-25AT (except soft cases).**
- **Volume and balance controls, plus separate squelch controls on top panel.**
- **Super easy-to-use!** For example, to recall memory channel, just push the channel number!
- **CTCSS encode/decode built-in!**
- **Automatic Band Change (ABC).** Automatically switches between main and sub band when signal is present.
- **Automatic offset selection on 2 meters.**
- **Tone alert system for quiet monitoring.** When CTCSS decode is on, the tone alert will function only when a signal with the proper tone is received.
- **Four ways to scan,** including ***dual memory scan,*** with time operated or carrier operated scan stop modes, and priority alert.
- **Automatic battery saver circuit extends battery life.**

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FLAVORIG!

80-meter CW transceiver from a Radio Shack transistor radio.

by Michael Jay Geier KB1UM

Breathes there a ham who has never pondered the idea of converting an AM pocket radio to ham use? I doubt it. I remember thinking about transistor radio conversion even as a shortwave listening kid, long before I became licensed. What would it take to get the BBC or Radio Australia out of one of those little gems? Could it be done?

Why Not!

Sure. Pocket radios, even the under $10 variety, are full-fledged superheterodyne receivers with AGC. A lot of the work of receiver design has been done for you! There's a perfectly good IF strip, a detector and an audio amp with enough power to drive the speaker. Sounds like a good start, doesn't it?

Of course, receiving strong local AM broadcasts is much easier than grabbing distant shortwave or amateur signals. In addition to the need for a BFO, overall receiver frequency stability must be made tremendously better.

Divide and Conquer

Pocket radios are designed to be cheap, and the greatest area of compromise is in the front end. Typically, a combination oscillator-mixer is used, and this arrangement is absolutely no good for ham use, because it tends to cause reception of more than one band at once (due to oscillator distortion), and may have birdies. Also, the oscillator is nowhere near stable enough for CW and sideband reception.

You can solve these problems by removing the original front end (usually just one transistor and its associated components), and replacing it with separate oscillator and mixer stages. With FETs and simple toroid coils, it's as easy as pie!

Photo A. Flavorig!

Description of the Transceiver

Flavorig is an 80-meter, Novice band 5 watt CW transceiver, built around a Radio Shack Flavoradio™, which sells for $6.95. It includes an RIT circuit, sidetone, and mini-key, and it operates on 10–14 volts, making it ideal for portable use. As much of the original radio as possible is used. In fact, several parts are REMOVED, with a few being used later, in other circuits. You can buy nearly all the parts at Radio Shack, and the few they don't sell can be ordered from Digi-Key Corporation or Radiokit (see addresses at the end of the article). Initial tune-up requires only another HF rig, an antenna, and a dummy load.

The Flavoradio's single-transistor front end is replaced with two FETs, Q1 and Q7 (see Figure 1). Q1 is an RF amp, whose input is the incoming signal, tuned by L1, mixed with the local oscillator signal provided by Q7. L1, by the way, is the original AM band antenna coil, tuned to the 80 meter band by pulling it part way out on its ferrite rod. The oscillator, used for both receive and transmit, is coupled to the receiver only via proximity, a technique which has several advantages, not the least of which is simplicity!

The IF, detector, and audio stages stay pretty much intact, with only minor changes to increase overall gain and selectivity. The BFO is provided by Q8, which generates a very stable signal by using a ceramic resonator similar to a crystal. The BFO requires no tuning or adjustments.

The transmitter is, of course, not native to the radio. The oscillator signal is shifted to the transmit frequency when the transmit/receive switch is set to transmit. Q9 buffers the signal, and it is coupled via L2 to the Q10 driver stage. L2 is the radio's original oscillator coil, now used as an interstage transformer. Q10 generates enough current to drive the gate of the Q11 final transistor, which provides between 1.5 and 5 watts of output on a 50Ω load. The filter which follows it cleans up the waveform, ensuring spectral purity.

The rig is keyed by providing power to the buffer, driver, and final stages. The oscillator runs continuously. Sidetone is provided by U1, a CMOS 555 timer, which is coupled into the audio amp. In transmit, the receiver is disabled via D4, which cuts off Q1.

Let's Get Started

If you're like me, right now you're thinking, "Oh, no, I hafta wind coils." Well, only two, and they're extremely simple. One has 15 turns of wire, and the other has 30 turns with a tap after the eighth turn. No transformers, bifilar, trifilar, etc. I don't like that stuff either!

After you get the radio and other parts, the first order of business is to remove some parts from the radio. Pop the case open and remove the screws holding the board. Now, refer to the schematic included in the instruction booklet, and unsolder and remove the following parts: C1, R1, R2, Q1, R3, C2, and C3.

Next, remove the oscillator coil, which is the can with the red core. Be sure to unsolder the tabs holding the metal can, as well as the coil pins. The can may come off separately, but that's OK; you can reassemble it, as long as you haven't damaged the delicate coil assembly. Do it carefully, because you'll use it later, in the transmitter! Now, remove R6, R7, and C5.

Take one of the toroids and about four or five feet of #26 enameled wire. Wind 8 turns through the doughnut, then pull out about one inch of wire and twist another inch back on it, to make a tap. Now, wind the other 22 turns. Run your soldering iron up and down the tap with a little solder. Spread the turns so that they go about two-thirds around the toroid. Finally, put some nail polish on the windings to keep them from unraveling.

You've just wound your oscillator coil. That wasn't so bad, was it? While you're at it, you might as well wind the other coil. This one's even easier. Simply wind 15 turns of the same type wire through the other toroid,

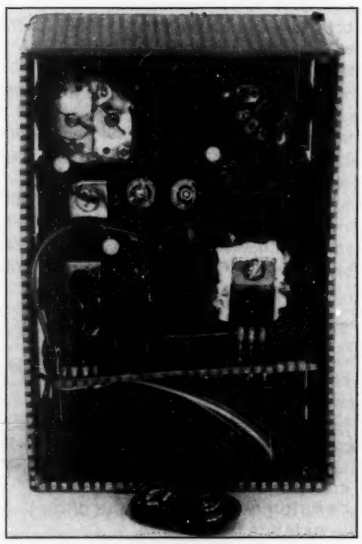
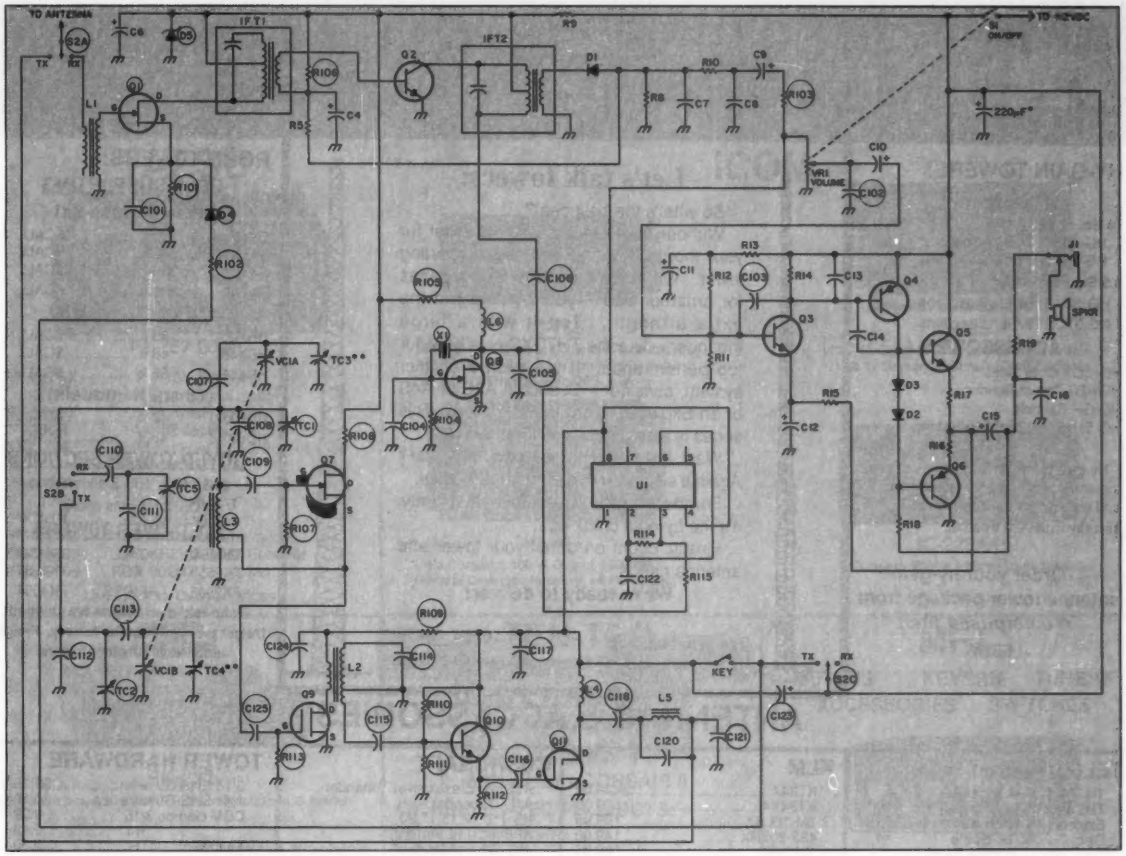


Photo B. Inside Flavorig. This shows the new board (horizontal) attached to Flavoradio's original board.



Schematic for the Flavorig. The internal trimmer of the main tuning capacitor is numbered differently from the original schematic, and there is no part number for the 220 µF capacitor.

Coil Winding Data

- L1: Radio's original antenna coil. Antenna coupling link is 3 turns, any kind of wire, wound over length of L1.
- L3: 30 turns of #26 enameled wire, tapped at 8 turns, on T50-2 toroid.
- L5: 15 turns of #26 enameled wire on T50-2 toroid.

spread the windings two-thirds around, then apply the nail polish.

Now, it's time to start building. First, install a 47kΩ resistor in place of the R6 you removed. Now, stand the oscillator coil on end, and glue it to the board approximately where the old one was, with the glue applied to the area of the coil which has no windings. Run the three wires through pre-existing holes in the board. If there's any slack in the wires, hold them to the board with nail polish, because any movement will cause a frequency change.

If you do some planning, you'll find that you can use most of the traces on the board for the new front end circuit, with a few cuts and jumper wires. Exactly how you lay the circuit out is up to you; it isn't critical. I used the existing holes and traces for the two FETs and the resistors, and soldered the small capacitors and the 6.1 volt zener diode to the foil side of the board, making cuts in the foil as needed.

I recommend mounting the trimcaps on the component side, just below the oscillator coil, to make tune-up easier. It's a tight fit, but it can be done if you mount the oscillator coil up as far as you can. As with any RF circuit, keep component leads as short as possible.

When you've got the oscillator done, look again at the original schematic. Make a foil cut between C9 and VR1 (the volume control), and add a 10kΩ resistor across the cut. Put a 0.01 mF cap from VR1's wiper (the center pin) to ground. Put another 0.01 mF cap between the base and collector of Q3. That completes the changes to the board.

Finishing Construction

You'll need to add a small board to the radio, to hold the BFO and transmitter circuits. I haven't included a PC board design, as most of us don't bother to make one for a single-quantity project. I used simple point-to-point perfboard construction, and glued the new board to the bottom edge of the radio board. Because I like my projects to be compact, I even used the curved space formerly occupied by the speaker magnet!

Wire the BFO and transmitter circuits and attach wires to the appropriate points on the radio. When connecting the transmit/receive switch, keep the wires short, and plan to mount the switch near the IF can with the black core. L2 is the OSC1 coil (with the red core) that you removed earlier. Looking at the coil with the pins down and the tapped side facing you, the ground connection is to the middle pin, and the 0.01 mF cap goes to the pin on the left. Turning the coil around to the untapped side, the FET connects to the pin on the right.

You must heatsink the IRF511 output transistor. Grease it with heatsink compound before attaching the heat sink. If you plan long keydown periods, or extended use at 13.8 volts, consider using a larger heatsink, as the transistor gets quite warm with the one specified.

You must shield the top part of the board, where the VFO and tuning cap sit, because hand capacitance will make it difficult to tune stations if these parts are unshielded. Copper-clad PC board makes a good shielding material. Just be sure to connect it to the rig's ground (the black wire coming from the battery terminals).

Continued on page 88

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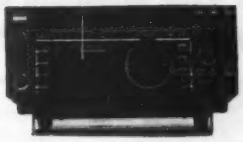

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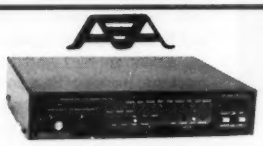

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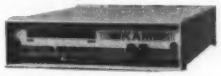

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73 Review by Steven K. Roberts N4RVE

Instant Track

The slickest tracker yet!

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Instant Track is the creation of Franklin Antonio N6NKF, a project motivated by, as he humbly put it, "a desire to learn something about orbital mechanics." During his year-long education, he produced a piece of code that redefines the state of the art in OSCAR satellite trackers. This PC program dramatically outperforms our government's high-tech satellite tracking tools. This is both exciting and scary: While our taxes buy multimillion dollar dinosaur technology that's already a decade old when it's finally put to use, individual creative hams build systems that run circles around it.

Map display for Instant Tracker.

Instant Track's quality is evident from the moment you bring it up on your screen. The program wakes up with a menu screen that lets you edit your station elements, any of the 200 satellites in its library (it comes with 115 sets of Keplerians already loaded, and tracks them all at once), and gives you a choice of functions. The startup screen even shows the status of your favorite satellites. Without hitting any keys at all you can see if they're up or down.

From here, you can graphically display the world with locations of sun, moon, and your bird of choice continuously updated, invoke a text screen that includes live data for multiple stations (essentially showing Az-El-PA-range data for each), and print a quick-reference operating schedule.

You can also display a massive multiscreen co-visibility grid that shows which satellites can see each other at any given moment (I'm not sure what this is good for, but it's interesting–and hints at just how much number-crunching is going on–inside Instant Track).

One of the first surprises occurs when you tell it your latitude and longitude. I painstakingly determined this from a USGS topo map, keyed it in, and the program correctly said: "1.8 km N of Milpitas, CA," and gave my grid square!

Squint Angle Window

Invoking the map display draws an excellent Mercator projection of the world on the EGA/VGA screen, overlays the sun and its terminator, a dot for the moon, a white X for your station, and a white block for the satellite you have selected from those available (in the selection screen, the ones currently in view are yellow, the others are green—a nice touch). The satellite is surrounded by its footprint, and there's a bonus: For birds such as OSCAR-13 where offpointing angle (squint angle) is an important factor, there's a SECOND footprint (blue) that delineates the portion of the earth's surface within 20 degrees of antenna boresight. This is MUCH more useful than a footprint alone. Any seasoned satellite operator knows that trying to work a bird when the antenna is aiming away from you at 120 degrees is pointless, even if you seem to be right in the middle of a perfect pass.

> ***". . . you can invoke the program and then continue with other tasks while the computer aims your antenna in the background!"***

The author took the graphic displays a lot further, making Instant Track as much an educational tool as a tracking system. If you press P while looking at the map, the screen clears and you get a round bird's-eye view of the earth, complete with latitude/longitude reference lines, footprints, and terminator. This display is beautiful, and seems to have become the one I most like to leave on the screen for company. Press P again, and the globe is replaced by an architectural 3-view display of the orbit, including an arrow if antenna orientation is a factor. Press the key again, and this gives way to a "sky view," which places the satellite against the current backdrop of major stars from the observer's viewpoint—helping you visualize where it is.

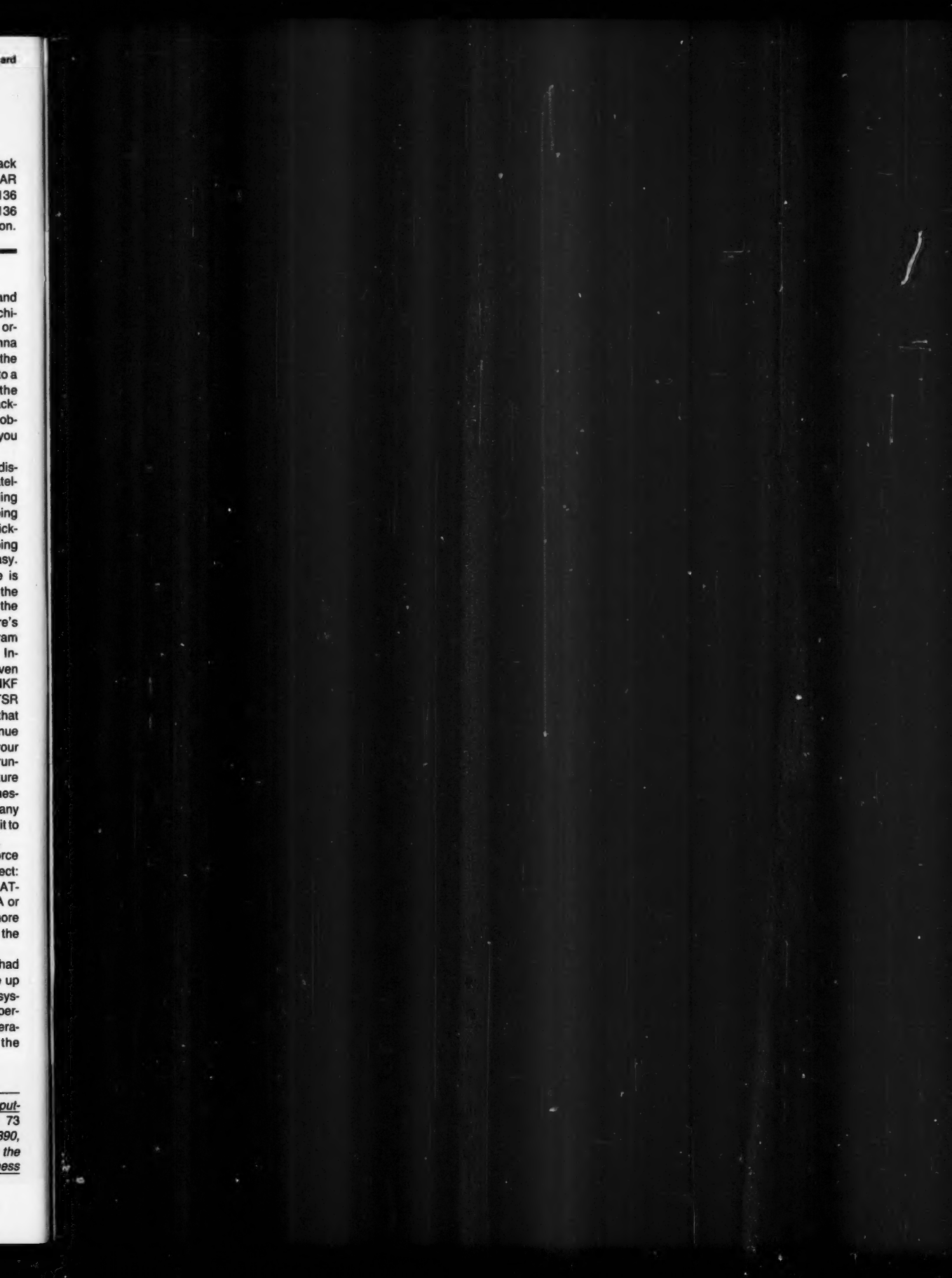
In any of the four graphic displays, switching between satellites is simply a matter of scrolling with the arrow keys—or popping out to the selection screen, picking a different bird, and dropping back into the map. Fast and easy.

Clearly, the user interface is spectacular, which is one of the reasons it was so dazzling to the pros from the USAF who visited me recently. But there's another side to a satellite tracking program that's all business—pointing antennas. Instant Track does that, of course, and even here there's an unprecedented twist. N6NKF has embedded all tracking functions in a TSR (terminate and stay resident), meaning that you can invoke the program and then continue with other tasks while the computer aims your antenna in the background! In my case, running the Microsats bicycle mobile, this feature will allow the DOS system to generate a message to the FORTH machine whenever any bird of interest comes into view, prompting it to turn on the station and attempt to connect.

System requirements for this tour-de-force of satellite software are as you would expect: You will get optimum performance on an AT-class machine with coprocessor and EGA or VGA display. But it will work, though more slowly and with less pizzazz, either without the math chip or on a vanilla XT.

Do I recommend it? In the month I've had Instant Track I have had no reason to fire up any of the other satellite software in the system. It has become the star of my demo repertoire, and makes scheduling OSCAR operation easy and pleasant. See you on the bird! 73

Steven K. Roberts N4RVE, author of Computing Across America and features in 73 Magazine, can be reached at PO Box 2390, Santa Cruz CA 95063. He now publishes the bi-monthly Journal of Hi-Tech Nomadness (subscription $15/year.)



HAM PROFILES

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Three years of hard work paid off for Nickol Santiago KB2GGW, age 15, the 1989/1990 Big Apple Ham of the Year. Nickol is known by countless hams around the country for her outstanding operating skills on the WB2JKJ 21.395 MHz Classroom Net sponsored by the Radio Club of Junior High School 22 in New York City, directed by Joe Fairclough WB2JKJ. She took to the airwaves in 1986 as a member of the "Education Thru Communication" class sponsored by the J22 club. "From the first day in Mr. Fairclough's class, I loved ham radio and wanted to get my own license." said Nickol.

As a finalist in the race, Nickol was invited to attend the Knoxville, Tennessee Hamfest on May 19th. Not only did she go, along with WB2JKJ, but she also got to state her views on ham radio from a young person's angle at a well-attended forum. Next up for Nickol was a trip to the Huntsville Hamfest and a week in Tennessee, thanks to the "ET (East Tennessee) Crew at 22" support group led by Carol Whetstone N4LFR.

Nickol Santiago KB2GGW examines her 1989 NYC Ham of the Year award with Joe Fairclough WB2JKJ, president of the Radio Club of JHS 22.

Nickol graduated this June from JHS 22, where she was active in ham radio and in the Legal Studies program. She is now in the 10th grade at Seward Park High School in New York City. She hopes to start a ham radio club there, using the resources of JHS 22. Nickol also works part-time in a bridal shop.

Extra Young Extra Class

Bill Crossley WK2X, age 14, is a ninth grader at the Frewsburg, New York, Central School. Both his father (John N2HBI) and his grandfather (Albert K2EHJ) are amateur radio operators. John is the president of the Chautauqua County Amateur FM Association.

Bill got his Novice license at age 11, after taking Jack Nord AC2D's evening course at the Jamestown, New York, High School. Thirteen months later he earned his Extra license.

Bill has spoken on amateur radio at a local Kiwanis Club meeting, and he is often introduced at Jack Nord's radio classes.

Besides amateur radio, Bill's interests are coin collecting and hunting. He will be taking the Hunters' Safety Course this autumn. He is also a member of his school's Spanish Club. 73

Bill Crossley WK2X—an Extra already!

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to *73*.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 25 cents!

Feedback#	Title
1	Welcome Newcomers
2	Never Say Die
3	QRX
4	Home-Brew: Flavorig!
5	Review: Instant Track
6	Ham Profiles
7	Home-Brew: The BitChaser
8	Review: Yaesu FRG-9600
9	Home-Brew: Bargain Audio Frequency Meter
10	Review: PacComm NB-96
11	Sing for the Unsung Heroes
12	Home-Brew: Easy Tuning for Uniden HR2510
13	Home-Brew: Three-In-One Antenna Tuner
14	Review: Elenco AC Adapter
15	Packet Talk
16	Homing In
17	QRP
18	Looking West
19	1989 Holiday Wish List
20	Above & Beyond
21	Dealer Directory
22	Letters
23	New Products
24	Hamsats
25	RTTY Loop
26	Index: 11/89
27	Ad Index
28	73 International
29	Book Review: Computing Across America
30	Special Events
31	Barter 'n' Buy
32	Propagation
33	Updates

SECOND PLACE
Home Brew IV Contest

The BitChaser

Digital counterpart to the oscilloscope.

by R.A. Cole K4OND

Digital devices and circuits are securing their foothold in the ham world, as well as in many household appliances. Whether you experiment, or repair your own gear, you quickly find that digital devices have their own requirements for test equipment.

While there's no substitute for a good o'scope for looking at repeating waveforms (whether analog or digital), scopes are almost useless for observing one-of-a-kind, short pulses typical of digital controls and signaling. At best, a good, triggered scope tells you a pulse occurred, and gives a brief image of its duration, but the image is quickly gone. An expensive storage scope will tell you a lot more, but it's pretty hard to justify on most ham budgets. Logic probes are cheap and easy to build, but they tell you almost nothing except that there was (or was not) some activity.

Many Uses!

You can use the BitChaser for digital signals, however, almost anywhere an oscilloscope is used, with the bonus that you can store the results as long as desired. Examples are many and varied—you can check the timing and structure of data characters coming out of a modem, RTTY demodulator, computer, keyboard, or packet interface; calibrate the speed and weight on an electronic keyer; track down and analyze spurious pulses in any kind of logic circuitry (much better than with a logic probe!); and check the "handshaking"(protocol agreement) between two digital devices (computer/printer, computer/modem, etc.). You can also use the BitChaser as a signal source, to generate 5, 7, or 8-bit TTY characters at any speed from 60 wpm to 9600 baud and higher. You can use it as a general purpose square-wave signal generator from sub-audio to 4 MHz. You can even use it as a crystal calibrator for the HF bands. With the optional "hidden" 96-bit shift register, you can use it as an RTTY or CW callsign generator.

BitChaser would be useful for checking out two recent *73* projects: "Control Your Rig from a PC" (August 89) and "Kaboom Micro Keyer" (September 89). In the first case, the project involves a computer-receiver interface with handshaking; the second involves using the BitChaser to calibrate the speed control on the Micro Keyer.

Digital Requirements

A major feature of a digital measuring device is that, since we do not have to be concerned with voltage levels other than 0 or +5 volts, we can use a simple display scheme instead of a complex and expensive cathode ray tube.

Photo A. Front panel of the BitChaser. The author used a junked Heathkit FET VOM case.

The BitChaser (BC) originally started out as a very simple device for capturing, freezing, displaying, and measuring pulses of almost any reasonable duration and repetition rate. After I finished the basic design, I soon found that a few simple and cheap additions would greatly increase the unit's functionality. For ten more dollars, I modified the BC into an incredibly versatile piece of test equipment, having the following capabilities:

- capture and display pulses from about half a microsecond up to several seconds;
- measure pulse length (duration) and duty cycle;
- measure time between successive pulses; (since this is the reciprocal of frequency when pulses are regular, it performs like a frequency counter, with a little math);
- synchronize the start of capture to the incoming signal (like a triggered scope), or from a separate external signal, or manually;
- stop the capture automatically, under control of a second signal, or manually;
- recycle, as much as desired, captured data for review, or for playback to some external device (which can't be done at all on a scope!);
- measure the time difference between a pulse on one line and that on another (something like a dual-beam scope);
- be programmed with any desired bit pattern, that then can be played back as a repeating signal source (as the RY generators in the Baudot TTY days), and;
- be used, with the internal clock brought out, as a variable or calibrated timing source for general purpose testing.

Thus, the BC is a combination of storage scope, frequency counter, bit-pattern generator, and logic probe. With a little external circuitry, you can even display CW visually. (Those blinking lights will fascinate shack visitors!)

How It Works

Figure 1(a) illustrates the basic idea of the unit. The BC uses a long serial-in/parallel-out shift register, with a discrete LED attached to each stage to display the contents. The clock (time base) performs the shift-right function, so that the signal coming in on the serial-in connection will be sampled and shifted into the register for display. With a clock period much shorter than the duration of the incoming pulses, each pulse will result in several samples of each pulse shifting into the register, lighting the respective LEDs. That is, if the clock period is one microsecond, an incoming pulse of 10 microseconds duration will light 10 LEDs, etc. The "0" levels between the pulses will result in the respective LED remaining off.

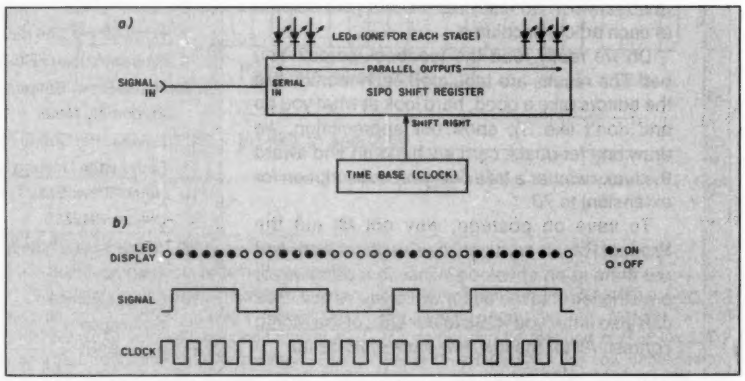

Figure 1. (a) Basic concept of function of LED signal display; (b) example display.

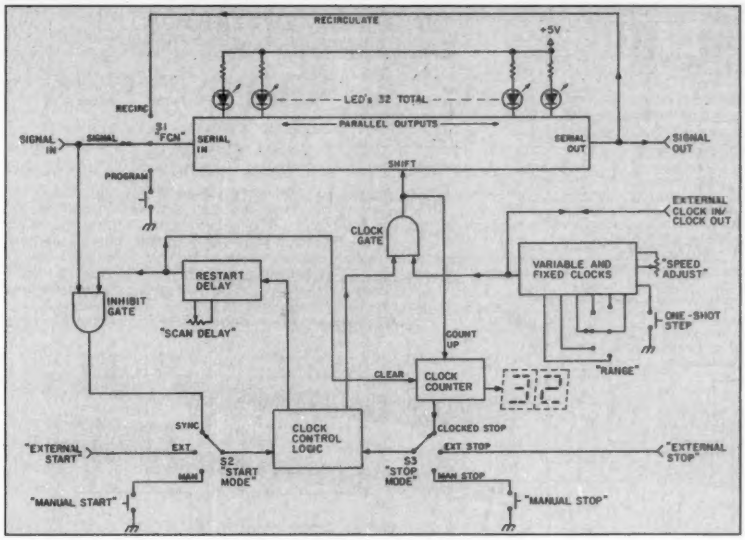

Figure 2. BitChaser block diagram.

Figure 1(b) shows a typical display for an incoming stream of pulses. While almost any display length is possible with this basic scheme, the unit described here uses a shift register and display screen of 32 bits as a compromise between adequacy of display and cost. You may decide to build a different length, although displays much shorter may not be very useful. This simplified circuit illustrates the concept, but suffers from exactly the same frustrating problem of the scope—unless you have a way to stop the clock, the display vanishes.

The Basic Design

Figure 2 is the expanded block diagram. The most important addition is that of "gating" for the clock, by sampling the incoming signal line. I termed this Synchronous Start Mode, analogous to a triggered sweep scope. With this feature, the BC sits and waits for an incoming pulse, then begins shifting the register. The clock counter counts the number of clock pulses, and stops the clock after 32 shifts, thereby freezing the display (Clocked Stop Mode). Once the clock gate circuit had been designed for the Synchronous Start Mode, it was trivial to add a switch and an input jack to allow opening the clock gate with an external signal, or by a manual push button, and to close the gate the same way. The Start Mode and Stop Mode switches, respectively, select these functions.

Note that the mode selections are totally independent. You can have a Manual Start and Clocked Stop, or any other combination that suits your purposes. The External Start and Stop connectors are useful to allow you to measure the time relationships between signals on two different lines. One is used as the signal, and the other as the External Start or Stop. The display measures the time between a negative-going pulse on the Start line and the next positive level on the Signal line.

The main use of the above feature is to observe the handshaking between two devices, like a computer and a printer, to see if one device is responding correctly to the other. For example, I had troubles with a printer omitting one or two characters at the end of a line. This turned out to be a timing problem during the carriage return—the "not-ready" signal from the printer was being ignored by the computer. This required an extra testing loop in the printer driver software to detect the "not-ready" condition.

A crystal-controlled oscillator and divider chain provide the main clock signal. These allow for precise measurements of pulse width by having a known time interval for each LED. (Analogous to calibrated time/division on a scope.) The circuit as shown provides time-per-LED periods of 0.25, 0.5, 1.0, 10.0 and 100 microseconds, and 1.0 or 10.0 milliseconds. Since the display is 32 LEDs long, this results in displays of 8, 16, 32, 320 and 3200 microseconds, or 32 or 320 milliseconds, respectively, of activity on the signal line.

Low resolution of the LED display limits

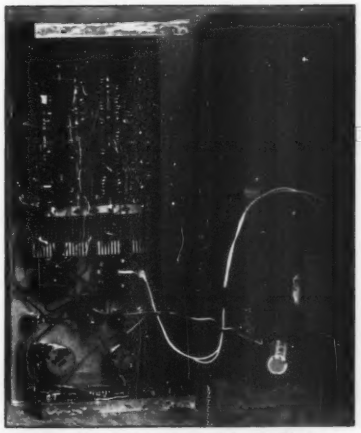

Photo B. Internal view of the BitChaser.

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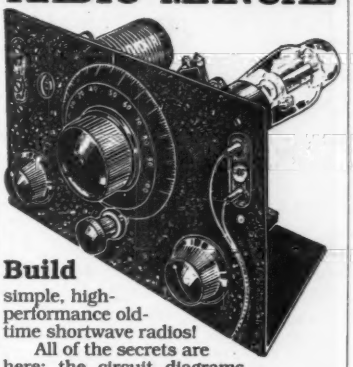

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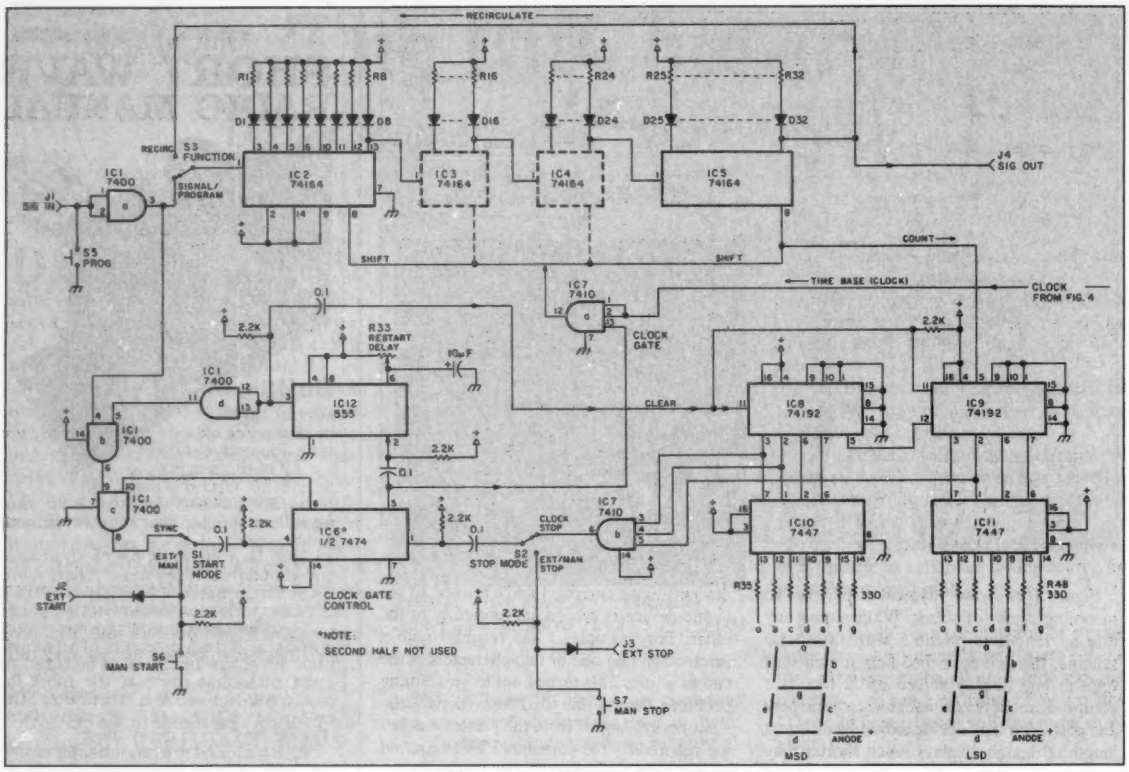

Figure 3. Shift register, display, and control circuitry.

precise measurement of pulse duration; a pulse duration of, say, 2.3 milliseconds would show up as either 2 or 3 milliseconds when using the 1.0 milliseconds-per-LED range. You can increase accuracy by shifting to a faster clock speed, provided the duration doesn't exceed total display length.

To increase flexibility when not much is known about the duration, timing, etc., of the signal source, I included a variable clock. This works much like the variable time/division adjustment on an oscilloscope.

Since you bring the clock out to an external jack, if you have a frequency counter, you can monitor the variable clock and determine the LED interval quite precisely.

With this basic practical design, you have an instrument that will allow you to capture pulses, freeze them, and measure their lengths, separations, etc., in a fairly automatic way, and represents the prime operating mode of the BC.

Modifications

A few more components greatly increase utility. The Restart Delay is a simple timer circuit that freezes the display for up to about 10 seconds, then re-activates the Synchronized Start mode for another sweep. In the Sync Start mode, the Restart Delay also prevents another pulse on the signal line from accidentally re-triggering the shift registers before you are ready. The 7-segment displays attached to the clock counters are useful at slow speeds (or when programming the display, as explained later), and they add very little to the cost, since the counters were necessary to create the Clocked Stop mode. The display freezes (after 32 periods), then resets to "00" when the Restart Delay times out. Thus, if the BC is just sitting there with the display showing "00," you know it is ready but no pulse has arrived.

Another nice-to-have addition was a programming push button switch, along with a one-shot clock. These allow you to enter any bit pattern into the shift register by holding down (or releasing) the Program button, and firing the one-shot clock. (You could just use a very slow clock along with the Programming button, but once you start programming that way, you can't stop until you are through!) Anything that will fit into 32 bits can be programmed; this includes several ASCII or Baudot characters, eight-bit data characters, or a couple of Morse characters (not a full callsign, though!). The bit pattern, whatever it is, can be sent out once, at any data rate available from the crystal or variable clocks, or it may be repeated as many times as desired by using the Recirculate feature.

Notice that although the shift register acts like a serial-in/parallel-out register, all of the contents come out serially, also! Thus, once a bit pattern has been captured by, or programmed into, the shift register, you can switch to the Recirculate mode, and recycle the bits back into the input of the shift register, at the same time that you output them to some external device. You can even change the time base during recycle, to repeat the same bit sequence at a slower or faster rate! This is useful, for example, in testing a printer or some other serial communications device with unknown speed capability–just send data at varying rates until it syncs and performs properly.

Shift Register and Control Circuits

All of the circuits are simple, non-critical TTL logic, with easy-to-find parts. The shift registers are 74164 8-bit serial-in/parallel-out registers; four of them are required to reach the 32-bit desired length (you can use as many as you want, though). 7400 NAND gates do most of the on/off gating of the various signal paths, and a couple of inversions.

Note that the input signal is inverted before it goes to the first shift register; this is because the LEDs are used in a pull-down mode, which requires the respective register position to contain a "0" to light the LED. Since I wanted the LED on for a high logic level, and off for low, the simple answer was to invert the signal, so that a high on the incoming line results in a low inside the register.

The clock gate (IC7a) is controlled by a 7474 flip-flop (IC6) in set-reset mode. The clock gate is opened by a high-to-low transition from either the signal (Sync Start), by an external, separate signal (Ext Start) or the manual push button (Manual Start). The opposite output of the 7474, which will be "0"

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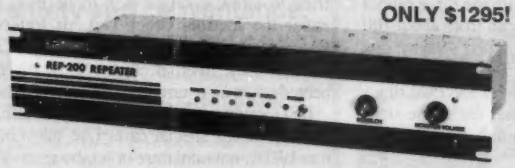

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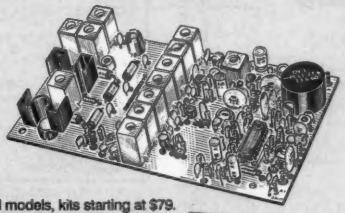

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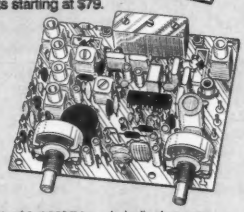

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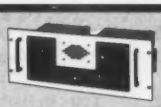

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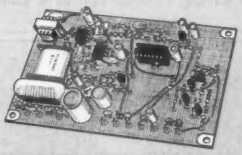

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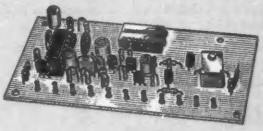

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when the count gate side is at "1," turns off the incoming trigger line by IC1c, to inhibit unwanted trigger pulses.

IC8 and IC9 perform the clock counting function, with IC7b decoding the count of 32 and providing the Clocked Stop signal to IC6, closing the clock gate, IC7a. You may also close the gate with an external signal or the manual push button. No matter how the stop is generated, the high-to-low transition of the clock gating signal (pin 5 of IC6) also fires the Scan Delay timer, IC12.

IC1d inverts the high level output of IC12 and turns off IC1b, again preventing any incoming signals from triggering IC6. When the timer times out, up to about 10 seconds later as set by R33, its output goes low, opening up IC1b again, and also resetting the clock counters, IC8 and IC9, to zero. (Note that the counters are cleared by parallel loading all zeros into the counters' preset inputs, not by using the normal clear function. This is because the clear requires a high pulse, and none is readily available at just the right time. The parallel load operation requires a low pulse, which is available.)

Time Base Circuits

See Figure 4. The clock is a straightforward crystal oscillator and divider circuits. I chose a 4.00 MHz crystal to give a 0.25 microsecond speed, then divided by 2 in IC14a for 0.5 microseconds; then again by 2 (IC14b) for the 1.0 microsecond rate. I followed this with a series of divide-by-ten counters to get speeds down to 10 milliseconds. Thus, at the fastest speed, the LEDs display 8 microseconds of signal activity (32 x 0.25 microseconds), and at the slowest speed, 320 milliseconds of activity.

You can start with a lower crystal frequency if you think you will not be going after pulse widths less than a microsecond, and possibly eliminate IC14a and b. You can also eliminate one or more of the decade dividers if you don't need the longest pulse width measurements. I do not recommend crystal frequencies higher than 4 MHz, unless you are willing to play around with the values of pull-up and coupling capacitors in the clock gate control areas.

The variable clock is one-half of a 556 dual timer in astable mode. With the three ranges and values shown, it will run from about 100 kHz (32 milliseconds of signal activity displayed) down to about 1 Hz (32 seconds of signal). The other half of the 556 dual timer (IC19) is the one-shot timer for single-stepping (e.g., during programming).

Construction

You can use just about any board layout and panel design. The circuits are non-critical at the relatively slow clocking speeds involved. You may have to play around with the crystal oscillator resistors and capacitor values to get reliable starting. You may also have to adjust the values of C1, C2 and C3 in the variable time base, IC19, to get continuous frequency coverage. (You can also add a couple of switch positions and capacitor values, if necessary.)

I made a few more shortcuts to hold down costs and save panel space. Notice that S1, S2, and S3 are SPDT toggle switches, even though they all have three positions. This is because one position can be common between two functions, with a little care. For example, S1 (Start Mode) uses a single position for either External or Manual Start; the diode protects an external signal source from short-circuit if the Manual button is pressed while still connected. The same holds for S2. S3 uses a common position for the Signal and Program functions; the protective diodes were considered unnecessary in this case. You can easily substitute three-position rotary switches, and omit the diodes.

S4, the Time Base Select, uses a similar trick to allow a single jack to be used for either the Internal Clock Out, or External Clock In; the extra switch position just assures that the internal clock will be disconnected when an external time base is used.

LED string assembly is the only construction that needs special care. Use sub-miniature LEDs, not miniature or jumbo sizes. The 32 diodes take up about 4 inches of space in a horizontal line. The subminiature LEDs are just a little too large in diameter to mount them in adjacent holes in the PC board, so grind or file off the opposite sides of the plastic bulb, being careful not to grind down to the actual LED in the center. I ground mine down with a Dremel tool. Each diode takes only a few strokes with a fine-tooth file.

The 10-LED Bar Graph displays (RS 276-081, at $2.99 each) produces the most attractive display with no hassles. If you go this route, you will either have to shorten the display to 30 bits (i.e., 3-bar graph chips),

continued on p. 48

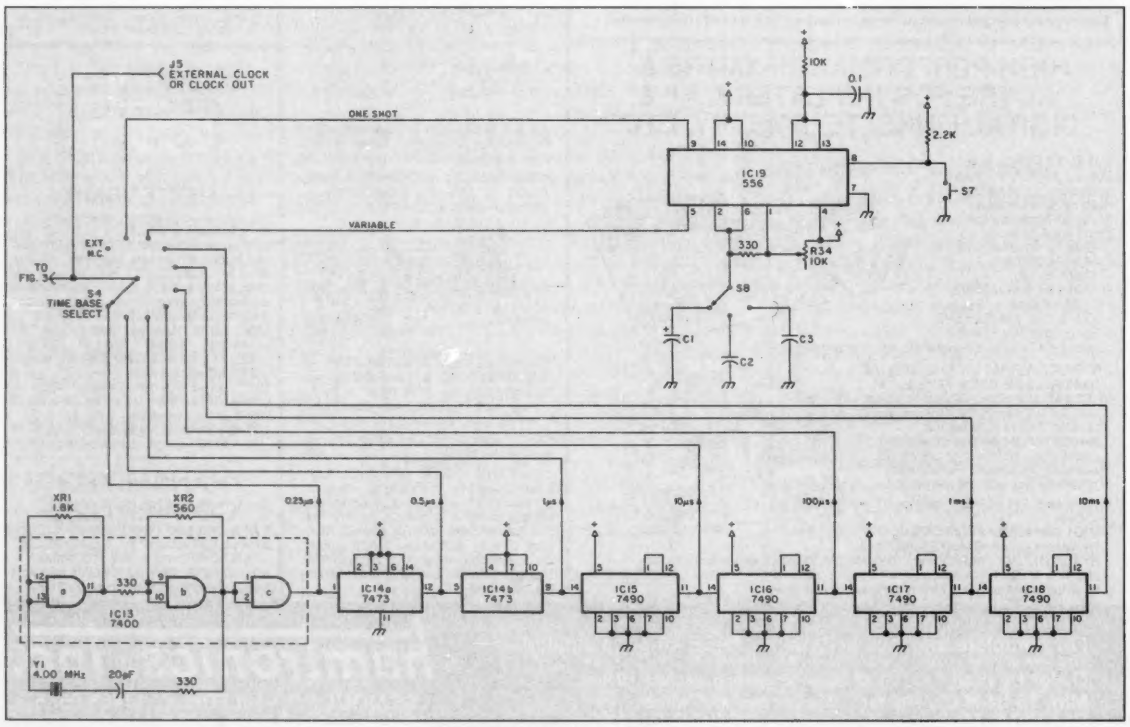
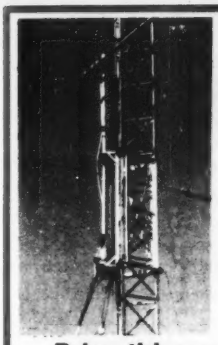


Figure 4. Time base circuitry.



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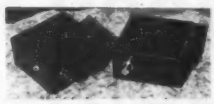

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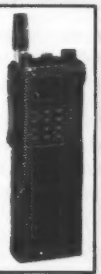

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Have you wondered what goes on in the VHF/UHF portion of the radio spectrum? You've probably worked some 2 meter FM and maybe some 440 MHz stuff—but there's a lot that goes on in the world between HF and microwaves. For instance, from my location, I can tune into a series of high-flying, radar-equipped balloons used to interdict low-flying drug trafficking aircraft, stretching from Texas to California. This activity is on frequencies assigned to the Drug Enforcement Agency (DEA). Frequencies for various other government agencies, including the FBI and the CIA, also abound in this large piece of spectrum.

Search For The Scanner

As it turns out, there are a number of multi-mode scanning receivers that cover this wide range. I asked knowledgeable friends and fellow hams about these various receivers: "How is the audio quality? What coverage does it have? How many different modes will it handle? Is it mobile/portable? How are the selectivity and the sensitivity? What are the scanning capabilities?"

For those who can afford it, the ICOM R-7000 and the R-9000 rigs may well be the way to go. I wanted something under $750, however, and found that the Yaesu FRG-9600 answers most favorably to all my questions above.

Spectacular Coverage

The 9600, in brief, is a multi-mode scanner covering 60 MHz through 905 MHz continuously. One feature that quickly impressed me was its keypad with 100 programmable memory channels. It may well be overkill to have this many memory channels on an HF rig covering under 30 MHz, but not so for the 9600, which accesses a chunk of spectrum over 840 MHz wide!

The 9600 doesn't have *all* available signal modes, but its six mode selections—FM and AM, each both narrow and wide, and SSB, both LSB and USB—will do nicely for most of the signals you'll encounter there. You can find ham communications here in all of these modes, but NBFM ("FM-narrow") is the most popular.

"FM wide" is used mainly for FM broadcasts (88–108 MHz), TV broadcasts, (scattered throughout much of the spectrum covered by the 9600), and cellular telephone transmissions (between 800–900 MHz). Be warned, however, that it is *illegal* to monitor cellular telephone activity! The 9600, unlike some other scanners of this range, does not block all these frequencies.

"FM narrow" is the standard mode for two-way police, military, business, and amateur communications. The ham bands the 9600 covers are 2m, 1.25m, 70cm, and the bottom three MHz of 33cm (902–905 MHz).

AM wide and narrow are used mainly for aeronautical communications, and some amateur work. You can find some aeronautical communications from 118–136 MHz and 250–300 MHz.

The FRG-9600 provides single sideband (SSB) reception up to 460 MHz. This covers amateur weak-signal work—typically voice SSB and CW—on all the above stated ham bands except 33cm. There's quite a bit of exciting weak-signal stuff to hear, including CW signals reflected off of ion trails left by meteors entering our atmosphere, and amateur satellite SSB and CW downlinked signals. The military also uses SSB in these regions.

The only drawback I spotted was that a desired mode—selected by a single control—can't be selected out of order. That is, in the mode-select order LSB, USB, AM-N, AM-W, FM-N, FM-W. If you are currently in USB and want to go to the other sideband, you have to step through the four AM and FM mode settings before getting to LSB. The upside, though, is that this system removes five extra controls from the front panel.

Quickly Accessing It All

The 9600 of course has a front-panel VFO control, but when dealing with such a vast piece of spectrum, it's MUCH easier to dial in a desired frequency from the keypad. Yaesu thankfully provided that here. They also didn't stint on the number of selectable tuning steps. FM-W allows 100 kHz tuning steps, while AM-W and FM-N allows for 5, 10, 12.5, and 25 kHz steps. Both AM-N and SSB allow 100 Hz and 1 kHz steps.

The scanning system allows either full or limited (keypad programmed) band scanning, as well as memory channel scanning, with auto-resume. Besides carrier-sensing scan stop, you can also select audio scan stop sensing to avoid stopping on "carrier-only" channels. I found that this feature works very well, and is very useful. You will be amazed to find so many of these carrier-only broadcasts throughout the spectrum—yet never hear any audio transmissions on them. Possible sources for these "broadcasts" may simply be harmonics of a TV or other broadcast, or deliberate jamming of a channel by an assigned user to prevent the channel from being used by someone else, as on HF foreign broadcast bands.

Scanning steps are displayed on the front panel. A two-color graphic S-meter on the display indicates received signal strength. A 24-hour clock timer is also included, along with a output for automatic power "On/Off" switching for recording transmissions automatically. Additional jacks provide CPU band selection outputs for remote computer control of the receiver, as well as multiplexed (FM wide) AF and RF mute and other control signals. There's also a mobile mounting bracket.

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Many newer transceivers have a data port that allows you to interface a rig to a computer and control many of the functions from that computer. Yaesu calls their system the Computer Aided Tuning (CAT) System, and have included it on the FRG-9600 in addition to many of their base and mobile transceivers and HTs. This allows direct control of the rig's CPU, allowing you to add virtually unlimited customized control functions in software,

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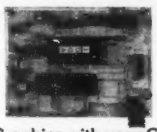

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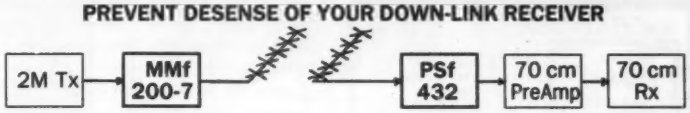

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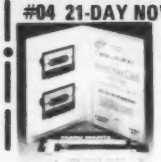

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such as multiple organized memory banks, auto tuning, and customized scanning systems—using almost any personal computer and a Yaesu FIF CAT Interface Unit (available as an option). So far, I know of no prepared terminal software for this. Engineering Consulting in Brea CA (714-671-2009), and Data-Comm, Int. in Hollywood FL (305-987-9505), however, have long worked on software for the CAT system in other Yaesu rigs, and may have something developed for the 9600.

I haven't yet tried CPU control because I don't have the CPU control interface—but I'm considering one for my laptop computer for an extraordinarily versatile and compact system. Both operate from 12 VDC, making it a good combo for portable/mobile use.

Options

Somewhat surprisingly, the AC adaptor (PA-4) is an option. The rig does come with a DC cable with a connector that plugs into the 9600's back panel. Be sure to read the manual so as to not confuse the positive and negative leads.

A TV video IF unit is also available as an option allowing reception of TV pictures (NTSC format) with a video monitor connected to the video jack on the rear panel.

Documentation

The 40-page instruction manual that comes with the FRG-9600 receiver is complete and comprehensive. The text is easily understood; it was either written in English, or expertly translated from Japanese. Also, all photos, charts, and figures are easily readable.

Unexpected Use

I have enjoyed listening to communications which include police, fire, sheriff, military, forest service, airline, government—and, of course, lots of FM broadcasts. One useful application I never expected was a "clean and correct emission verifier" on the 72 MHz radio-control bands for a major model sailplane contest. In this event, last May in Washington State, the 9600 monitored the radio control frequencies for interference and checked each R/C transmitter for output on the proper channels for 125 model sailplanes. No planes were lost due to interference!

Specifications

Frequency Range:	60–905 MHz (up to 460 MHz for SSB)	
Modes, 3dB Bandwidth:	FM Narrow	15 kHz BW
	FM Wide	180 kHz BW
	AM Narrow	2.4 kHz BW
	AM Wide	6 kHz BW
	SSB	2.4 kHz BW
Conversion Schemes:	Triple (FM-N, AM, SSB)	
	Double (FM-W)	
	Single (Optional TV Video Unit)	
Intermediate Frequencies:	45.754, 10.7 MHz, and 455 kHz	
Image Rejection:	60–460 MHz	−50dB typical
	460–905 MHz	−40dB typical
Typical Sensitivity:	FM-N	0.5µV (for 12dB SINAD)
	FM-W	1.0µV (for 12dB SINAD)
	AM-N	1.0µV (for 10dB S+N/N)
	AM-W	1.5µV (for 10dB S+N/N)
	SSB	1.0µV (for 15dB S+N/N)
Tuning Steps:	FM-N*	5 / 10 / 12.5 / 25 kHz
	FM-W	100 kHz
	AM-N	100 Hz/ 1 kHz
	AM-W*	5 / 10 / 12.5 / 25 kHz
	SSB	100 Hz / 1 kHz

*Selected steps shown on display.

Memory Channels:	100	
Audio Output:	1W (into 8Ω, with less than 10% THD)	
Power Supply voltage:	DC 12–15V	
Power Supply current:	Operating	550 mA (maximum)
	Power Switch off	100 mA
	DC Supply off	3 µA max. (backup)
Case Size (W x H x D):	180 x 80 x 220 (mm)	
Weight:	2.2 kg (4.9 lb.) without options	
Supplied Accessories:	Whip antenna (0.6m)	
	DC Power Cord (1.8m)	
	MMB-28 Mobile Mounting Bracket	
	Wire Stand	
Options:	AC-DC Wall Adapter (PA-4B for 110–120V, or PA-4C for 220–240V)	
	Video Unit (NTSC)	
	SP-55 External Speaker	

Bringing Back The Memories

The FRG-9600 memories are arranged in ten banks of ten memories each. You can program each decade with its own mode/bandwidth combo. I find this very useful—one decade contains frequencies for FM broadcast stations around the state, another contains frequencies for the local police, fire, sheriff, forest service and EMT/med-Evac frequencies, and a third decade contains aircraft and air route traffic control frequencies. A fourth decade contains military aircraft air-to-air and air-to-ground frequencies. (In Arizona there is a lot of military aircraft communication on an almost round-the-clock basis.) If I wished, I could put in FBI, Treasury Department, CIA and other frequencies, in a new fifth decade. That still leaves another 50 memories.

Antenna

The telescoping and swiveling whip antenna that comes with the receiver is 23" long fully extended, and attaches to the receiver via a PL-259/SO-238 connection. This antenna does quite well, considering its size. If you live in an RF-rich environment, such as an urban area, you may find this antenna not only adequate, but even preferable to one with more gain, so as to reduce front-end overload. When you start getting into UHF, however, I suggest you use a matched antenna located high and in the clear, connected with low-loss hardline coaxial cable—just as you would if you were using a transmitter. Of course, you can use the FRG-9600 as a separate receiver in connection with a transceiver covering roughly the same frequencies.

The only nit-pick here is the chassis connector used. For serious VHF and UHF work, an N-type connector is a better choice.

An "A" for Audio

In my opinion, this receiver provides audio quality as good as, or better than, many other receivers I've used. Although there is a built-in 2-½" speaker in the top of the cabinet, I prefer an external speaker of good quality for personal listening on FM broadcast. If you wish, you can also use the built-in jack for earphones in high ambient noise levels.

Conclusion

In sum, the FRG-9600 is a rugged, compact, high-quality communications receiver with versatile scanning capabilities. It represents very good value for the money, and I recommend it to interested VHF and above band scanners without hesitation.

The author wishes to thank Universal Shortwave Radio from whom the receiver was obtained for testing. I have just become another satisfied customer!

Jim Gray W1XU, 210 Chateau Circle, Payson, Arizona 85541, has been 73's Propagation columnist since 1984. He's been a ham for 39 years, and likes to operate CW on WARC bands 12, 17, and 30. He's also interested in aviation and photography.

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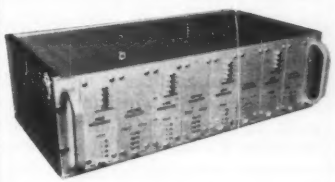

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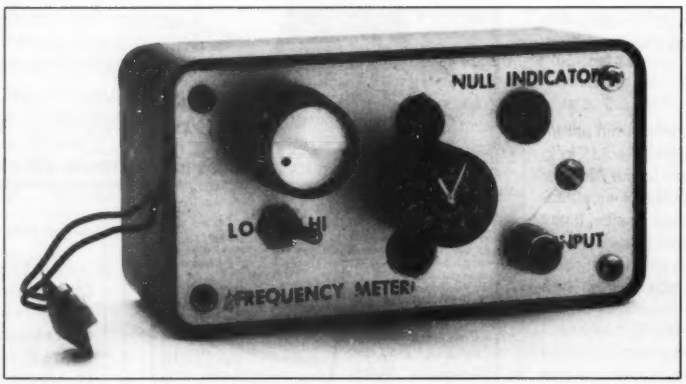
Bargain Audio Frequency Meter

Build this vital addition to your test equipment bench for about $10.

by William Lazure KB5CTH

If you like construction projects, you need a stable and sensitive audio frequency meter. If you are a ham, chances are you'd like to get this meter as inexpensively as possible. The following project meets both criteria. If you purchase all the parts new, the entire project costs about seven dollars. The device gives a fairly sensitive reading from 60 Hz to 100 kHz.



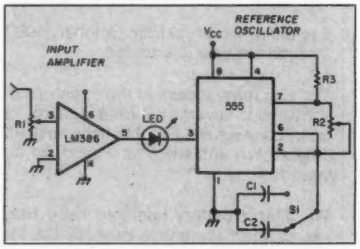
How It Works

The meter is actually a frequency comparator much like a BFO. The input frequency is amplified and applied to one side of the indicating element (a simple LED). An internally generated frequency is applied to the other side of the LED. When the internal oscillator is equal in frequency and phase to the incoming signal, the LED goes out. You read the frequency of the internal oscillator off of the potentiometer that varies the frequency of the internal oscillator.

The internal oscillator is just an NE555 timer/oscillator IC wired for the astable mode. S1 switches one of the range capacitors in and R2 varies the frequency through that range. Low range (C1) covers about 60 Hz to 3 kHz, and high range (C2) goes from 2500 Hz to 130 kHz. The output of this oscillator is a square wave of about 3–5 volts.

The input signal goes through R1, which sets the input amplitude to the amplifier. The amplifier IC is an LM386 programmed for a gain of 20 (pins 1 and 8 are open). There is no coupling capacitor on the output of the amp because the amplified signal is automatically set at half of supply voltage by the amp. We need this signal to be biased above ground to match the output of the internal oscillator, which is also biased above ground. You can use almost any type of LED, since both active elements are capable of sinking or sourcing up to 200 mA. The current drain is quite low, so the use of a battery is sufficient. The voltage of the battery doesn't have to be exact because the 555 shows a constant frequency over a wide range of supply voltage.

Construction is not critical. The timing capacitors can be ceramic, Mylar™, greencaps, or any combination. However, the 100k pot (R1) must have a linear, not an audio, taper. When a pot has an audio taper, the upper frequencies on both ranges will be "bunched" together, making it nearly impossible to differentiate between frequencies. I used two separate boards so the meter could fit into any small box. This makes the meter more versatile, to suit your needs.



Schematic for the input amplifier and reference oscillator.

Parts List

Part	Description	RS#	Price
LM386	400 mW amplifier	276-1731	$1.09
555	timer/oscillator	276-1723	1.19
LED	any type	276-026	.35
R1	10kΩpotentiometer	271-1715	1.09
R2	100kΩ linear pot	271-092	1.09
R3	1kΩ ¼W resistor	271-023	.10
C1	0.1µF capacitor	272-135	.30
C2	0.0022µF capacitor	none	.50
S1	SPDT switch	275-613	2.59
	Case	270-230	1.69
	9V battery clip	270-325	.20
Total cost			$10.19

Calibration

To calibrate the meter, you'll need an oscillator with a known output frequency. Mark the internal oscillator pot (R1) with a series of divisions and set the pot to the first division. Tune the calibrating oscillator until the LED completely nulls, and mark the division on the pot with the frequency of the calibrating oscillator. Do this for all of the divisions in both ranges, and you're done.

If you can't get the LED to null, check the level of the signal going into the amp. Try placing the input potentiometer at a different level and then tuning the oscillator. You should be able to find a point where the LED will at least dim. With fine adjustment between the frequency setting and the input level, you should be able to turn off the LED.

Using the Meter

Simply rotate the internal oscillator pot until the LED extinguishes. The frequency marked on the scale of the pot is the frequency of the incoming signal.

This meter should prove to be one of your more useful pieces of test equipment. Its simplicity makes it almost problem free, and its versatility makes it useful for many other applications. Use your imagination, and I'm sure you will find numerous uses for it. 73

William Lazure KB5CTH, 1317 Commanchero Dr., Colorado Springs CO 80915.

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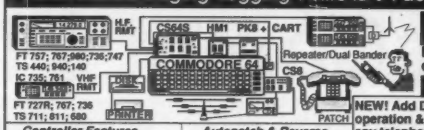

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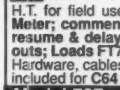

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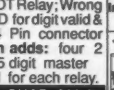

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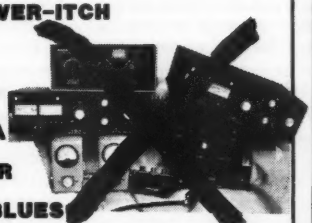

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73 Review

by Thomas A. Moulton W2VY and Robert A. Buaas K6KGS

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Looking for a way to get on higher speed packet but don't want to spend a bundle? These reviewers recently discovered a product that gave them many times faster packet operation without having to change rigs. In a number of cases, readers will also be able to use this modem without having to significantly modify their rigs or TNCs.

The PacComm NB-96 modem, licensed from James Miller G3RUH, the designer, is cost effective for high speed packet operations at 9600 bps. The NB-96 circuitry is mounted on a 3" by 5" card (see photo), and installs on any TNC-2 style modem disconnect header. It meets FCC bandwidth requirements for use on 50 MHz and above. Bandwidth is typically 16 kHz (26 dB) when operated at the recommended 3 kHz deviation.

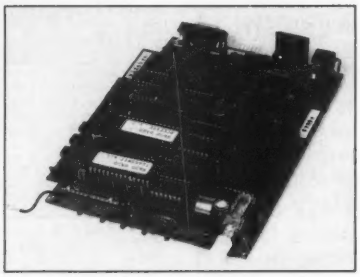
Selecting Your Radio

Your 9600 baud packet rig must meet four criteria: true frequency modulation, fast switching, fast receiver recovery, and a 20 kHz receiver IF. The NB-96 Modem takes advantage of the fact that you can transmit data at 9600 bps using a phase-linear channel capable of 4800 baud. In this particular case, the modem requires near-DC to 4800 Hz response.

FM vs. PM

What is the mode if it isn't "true FM?" Most so-called FM rigs, particularly many HTs, use a mode similar to FM, called phase modulation (PM). PM is widely used because it's easier to implement in most circuits than FM. The principal reason for this is that the design of an "FM-able" source oscillator is more complex. In PM you don't need to FM the source oscillator. The disadvantage of this mode, however, is that it changes the transmitted frequency based on the voltage of the modulator and the rate at which the voltage changes, which serves to distort the phase relationship. This is fine for voice communications, where low distortion doesn't seriously degrade the intelligibility of the signal, but high speed packet requires very high linearity.

Radios that modulate a varactor within the synthesizer PLL usually generate PM. If you have a radio that uses single conversion to get to the operating frequency, you can modulate the crystal in the mixer.



The PacComm NB-96 high speed modem card, mounted on a PacComm TNC-2 type TNC card.

Usually, crystal-controlled radios generate true FM. When they don't, you can easily modify them to generate FM by adding a varicap in series with the crystal.

Transmit Waveform Generation

The NB-96 contains a randomizer made from an m-sequence pseudo random number generator, the output of which is combined with the input data. The data stream has an even distribution of 1s and 0s. This has some good effects: the signal is always an AC signal; you can more reliably extract NRZI clocking information; and the energy is more evenly spread throughout the occupied bandwidth of the signal. Since the input data stream is NRZI HDLC, zero bit insertion and clocking information assure a steady supply of transitions which will help avoid randomizer lockup.

Electronic Switching

Due to the high data rate, your radios should be able to switch quickly from transmit to receive, and vice versa. For example, 100 ms (0.1 second) is enough time to send a 100-byte data packet between two directly connected stations. The same packet sent at 1200 bps would take 800 ms.

Use PIN diodes for antenna switching because mechanical relays are slow.

Most synthesized radios use a single PLL for both transmit and receive. The PLL usually has to lock on frequencies that are as much as 10 MHz apart. It can take a lot of time to reprogram and lock the PLL. Some crystal-controlled radios completely turn off the entire receiver, including all oscillators, which can cause delays as long as 1 second. Small, handheld radios (HTs) may fail one or more of the above criteria; we haven't tried interfacing to any.

Evaluate the receiver IF filter(s) carefully. James Miller makes a big point about the required bandwidth of the filters, the need for very good phase linearity, and group delay. If the receiver you are using has two filters, the first filter (10.7 or 21.4 MHz) should have 20 kHz (D suffix) bandwidth, and the second filter (usually 455 kHz) should be wider, enough so that its skirts do not appear in the overall bandpass. 30 kHz (B or C suffix) is usually wide enough, because these ceramic jewels are seldom centered exactly on 455 kHz.

A simple test with a communications test set tells you if the receiver will perform well. Set the synthesized signal generator in the test set to channel center and adjust the RF signal amplitude for 20 dB noise quieting. Look at the receiver output (at the demodulator, with no de-emphasis, or at the output of the modem bandpass filter) with a scope, while modulating the signal generator with frequencies from 20 Hz to 4800 Hz. The amplitude and shape of the wave should stay the same regardless of the modulating frequency. Set the signal generator above and below the center frequency by 1.0 kHz and check for serious wave shape distortion. Decrease the deviation if necessary to improve the shape. Note the amount of deviation used to accomplish this (it will probably be smaller that you might imagine).

The rule-of-thumb bandwidth equation:

$$B = 2f + 2d$$ where:

B is the bandwidth, f is the highest frequency in the modulation, and d is the deviation from channel center outward. For $B = 16$ and $f = 4.8$, $d = 3.2$ (all values in kHz). This leaves room for $\pm$ 2 kHz system drift over time.

TNC Selection

Most prominent TNCs have modem disconnect headers available for connection to external modems like the NB-96. This header is usually a printed circuit pad pattern which accommodates a dual-inline connector. Before installing the connector, be sure to cut the traces which connect the SIO to the internal 1200 baud modem. For testing, we suggest

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This gives you the precise control you need to get minimum SWR and maximum power into your antenna.

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The excellent form factor of the short fat coil gives you highest Q. Plus you get plenty of inductance that gives you a much wider matching range than other designs.

This results in a highly efficient tuner that puts maximum power into your antenna *and* a compact 10 x 3 x 7 inch size that complements your rig and fits right into your station.

Competing tuners using *two* tapped coils *require* a large cabinet -- not just to house the coils but also to help reduce detrimental coupling between the inductors. The result? *A tuner that's* ***bigger*** *than your radio.*

Your very best value

The MFJ-949D gives you your very best value, first-rate performance, proven reliability and the best guarantee in ham radio . . . all from the *most trusted* name in antenna tuners. Don't settle for less. Get yours today!

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MFJ-962C

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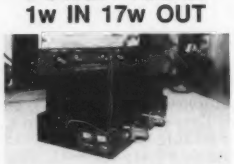

The low power driver is a separate stage from the high power output stage. Each unit is encased inside a separate die cast box which is enclosed in a large 4-1/2" x 8" cabinet with a double heat sink. The linear has power binding posts, is fused, has an "ON" light, and is diode protected. Connectors supplied are "N", but other types are available. The units are spray painted black with an acrylic finish.

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making a jumper plug to reconnect them when needed.

Follow the instruction provided with the NB-96 and with your TNC. The NB-96 instructions covered the interfacing of the modem to the TNC and gave general guidelines for interfacing the modem/TNC combo to rigs. As the product is still quite new, there's still not much information about interfacing it to specific ham rigs, and the manual asks users to send PacComm such information as it comes up. They may include it in future versions of the docs. For now, however, be prepared to know something about interfacing these units to ham rigs on the rig end. They do, however, have quite a bit of info on interfacing to specific commercial telemetry rigs (see below).

Be sure to verify that the TNC provides a TAPR TNC-2 style modem disconnect header. We interfaced to the TAPR TNC-2, the MFJ-1270, and the PacComm Tiny-2 with equal success.

Up the Data Rate Further Still!

Yes, it's possible to double the data rate to 19.2 Kbps. Just halve the values of the frequency-determining capacitors in the NB-96 receive and transmit active filters, and double the clock frequency. Similarly, to halve the data rate (4800 bps), double the capacitor values and halve the clock. The NB-96 documentation lists the capacitors you need to change. As the bandwidth required is only 35 kHz, you can operate 19.2 Kbps on the 1.25m and shorter wavelength bands.

Of course, going to 19.2 Kbps requires higher IF widths in your rig. You need 30 kHz for the first IF filter in the receiver. Change the second IF filter to provide 40 or 50 kHz at the 6 dB point. Ceramic filters usually won't make this bandwidth, even by careful selection. One solution is to use several LC cans, loosely coupled and stagger tuned, to provide a uniform response. Making this work is eased considerably if you have a 10.7 MHz sweep generator, the kind broadcast FM radio technicians use.

Transmitters

The transmitters K6KGS has used either already had a varicap in series with the crystal, or one added. The NB-96's modulating voltage couples directly to the varicap. He has used both the Hamtronics and Spectrum Communications 220 and 420 MHz transmitters as well as commercial Motorola Micor exciters, using the special Channel Element which provides Automatic Frequency Control (KXN-1019) without modification.

K6KGS has also used Midland 13-509 220 MHz transmitters, which are popular hamfest items. All he did was remove the phase modulator and add the varicap modulator. With a few modifications to the Midland radios, the RX/TX switching and the TX/RX switching was brought down to 3 ms each, which is acceptable. You can get the specifics on interfacing these rigs from Bob Buaas K6KGS at PacComm.

All of K6KGS's synthesized rigs switched the VCO between frequencies for receive and transmit. This transition took about 120 ms in each direction. This equates to a "DWait 12" and "TXDelay 12" (i.e., 120 ms each). This time delay at 9600 baud is equivalent to a 128-byte data packet. You can see that these time delays are unacceptable. Units with separate internal VCOs for receiver and transmitter might be acceptable if the direct modulation characteristics are phase linear, but I do not know of any such units on the ham market. Many comtemporary rigs, which are by and large PLL rigs, have time delays of at least 100 ms.

K6KGS has had five stations running 9600 and 19,200 baud continuously for more than six months, using a combination of modems, radios, and frequency bands, with no problems. The longest path is 80 miles, between mountaintops.

Telemetry Radios

Thomas W2VY integrated the modem with different radios, mostly telemetry radios, with very few problems. Some of the most commonly used of these rigs are Maxon VHF HTs and 30W mobile UHF rigs, and Johnson VHF rigs. Little, if any, alignment is necessary. When it is necessary, all you need is an audio oscilloscope with external trigger. W2VY found that the best way to tune the receiver to the correct frequency was to use the scope as a tuning eye, then adjust the received data for the cleanest waveform.

Telemetry radios operate from 1W to 5W. On the surface this may sound like weak-signal work, but FSK gets about 6 dB gain in the signal-to-noise ratio over AFSK. Running 5W FSK is like 20W AFSK.

Major radio dealers, such as Motorola, Johnson, Maxon, and Standard, have telemetry radios in the $300 price class. Contact PacComm for more information.

One-Evening Project

If you've selected the right radio, it takes only an evening to interface it to the NB-96. Compared to 1200 baud, the systems exhibit substantial throughput improvement. The systems were relatively easy to construct, using only the most unsophisticated test equipment. Currently in amateur packet radio, 9600 baud is a common backbone rate, while user rates are still at 1200 baud. As the backbone data rates increase, however, to 56Kb and beyond, 9600 baud will be a natural step for user access channels.

The modem also has an EPROM and jumpers to "optimize" the characteristics of the transmitter and receiver of a specific link, as a way to make the modem more accommodating to different rigs. We found this feature unnecessary, however, and evidently PacComm received enough similar feedback to lead them to remove jumpers JP1–JP4 and the EPROM on the surface mount version.

Suggested Improvements

James Miller suggests that you run the modem transmit output stage at 1V peak to peak minimum, and use voltage dividers to feed the rig's modulator. In some cases you'll have to add an external resistive pad to bring

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PS-35 Internal power supply	219.00	**199**95
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IC-735 HF transceiver/SW rcvr/mic	1149.00	**999**95
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AT-150 Auto. antenna tuner ***(Special)***	445.00	**369**95
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

IC-725 Ultra compact HF xcvr/SW rcvr	949.00	**829**95

Other Accessories	Regular	SALE
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PS-30 Systems p/s w/cord, 6-pin plug	349.00	**319**95
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SM-10 Compressor/graph EQ, 8 pin mic	149.00	**139**95
AT-100 100W 8-band auto. ant. tuner	445.00	**389**95
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UX-59A 6m 10w unit	349.00	**319**95
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IC-2400A 45w 2m/35w 440 FM/TTP	899.00	**789**95
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Larsen PO-K Roof mount	23.00	
Larsen PO-TLM Trunk-lip mount	24.70	
Larsen PO-MM Magnetic mount	24.70	
RP-1510 25w 2m repeater	1849.00	**1649**
RP-2210 220MHz 25w rptr ***(Special)***	1649.00	**1399**
RP-1210 1.2GHz 10w 99 ch FM rptr	1529.00	**1349**

Due to the size of the ICOM product line, some accessory items are not listed. If you have a question, please call. All prices shown are subject to change without notice.

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LC-11 Vinyl case for DIx using BP-3	20.50
LC-14 Vinyl case for DIx using BP-7/8	20.50
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BP-2 425mah/7.2V Nicad Pak - use BC35	49.00
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CP-10 Battery separation cable w/clip	22.50
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LC-2AT Leather case for standard models	54.50
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HS-10 Boom microphone/headset	24.50
HS-10SA Vox unit for HS-10 & Deluxe only	24.50
HS-10SB PTT unit for HS-10	24.50

For other HT Accessories not listed please CALL

Receivers	Regular	SALE
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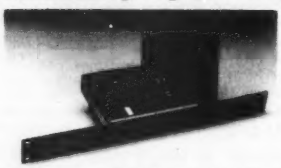
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your drive voltage down low enough for the transmitter. PacComm may want to consider building this onto the board in future versions of the NB-96.

Multi-Speed Channels

DON'T try to use modems of differing data rates on the same channel—unless you have very good control of ALL the stations on the channel, such as a network trunk.

Why? This is because packet stations currently use Carrier Sense Multiple Access (CSMA) which assumes that every station can hear every other station. A station that your station can't hear is called a hidden transmitter. This means you will transmit, A TNC may not "hear" a transmission of a foreign data rate because it decides that that signal is not a signal, and so transmits. Nonetheless, the wave energies appearing simultaneously on the channel mutually corrupt packets, causing retries, dragging down throughput.

When two stations are running different modem speeds, they will generally appear as hidden transmitters to each other. If all the packet controllers on a channel are connected to the radio using the RFDCD line, multi-speed operation can work. The RFDCD signal from the radio should be active when an RF carrier is present. In practice, this doesn't work with 9600 bps carriers because most radios are looking for a voice carrier. The noise detector will see the high frequency components of the data and decide it is only noise for all or part of the packet. Most stations are not wired this way, and it only takes one station on the channel that's not wired this way to destroy throughput.

Because of the variety of equipment used, multi-speed channels aren't practical. To provide 9600 bps user access, an existing channel must be cleared, or a new channel opened up for high speed operations. Currently, the most attractive idea for accommodating these channels is to alternate them between 1200 baud packet channels from 144.9–145.1 MHz. Before doing anything, however, be sure to clear it with your local repeater coordinator. Network trunks are usually set up with local/regional coordination between packet network providers, so conversion to higher speeds is much easier.

Most amateur packet stations are not equipped to support multi-speed operation, and the problems of detecting all carriers vs. speed segregation need to be examined more closely.

Other modems, such as the K9NG Modem and the modem on the new UoSAT-D scheduled for November launch, should be compatible with the NB-96. This will allow you to operate packet with this new bird.

Conclusion

We have found this modem to be relatively easy to implement, and has not given us any troubles for the combined year that we have been using it. For anyone who is not afraid to perform to perform a few minor modifications to their equipment, we wholeheartedly recommend this product. ■

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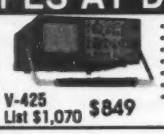

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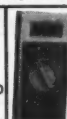

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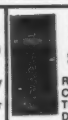

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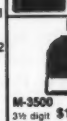

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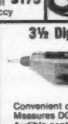

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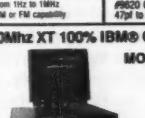

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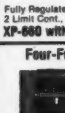

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Sing for the Unsung Heroes

Give credit to your club's workhorses!

by Jack Parker K5CVD

November and December are two of my favorite months. November is the advent of the holiday season, and December gives us a chance to do something good for someone else. I don't mean just giving Christmas presents, either.

During November and December, most amateur clubs around the country hold an end-of-the-year celebration. It doesn't matter whether it's called the annual awards banquet, a Christmas party, or a New Year's celebration. What matters is that this is the occasion when the outstanding members of the previous year are honored. It is an exciting time for many of us.

I suggest here a way to make it even more exciting and meaningful.

In every organization there are people who give quiet, ongoing service to their fellow members, without expectation of recognition. The services these humble folk render are usually necessary drudge tasks that others do not wish to do, but that must be done by somebody.

"Drudge tasks?" you ask. "What tasks in our hobby would anyone associate with drudgery?" Well, friend, there are numerous jobs that get done every day that involves a lot of slogging—very late and very early hours, hours of routine, etc.—for the person doing them, but which bring joy and satisfaction to others. Let's consider a few.

Our Very Own Public Utility

It's three o'clock in the morning. You slowly turn the tuning knob on the TS-140 hoping for that weak station you haven't worked yet, when suddenly the lights go out, the rig dies, and a painful silence fills the night where the merry hum of a distant generator sang just seconds before. After sitting for a moment, startled, you begin rummaging around the tent for a flashlight you hope is there somewhere, and finally roar in anger and frustration, "Curse you, Murphy!!!"

Then, as you are about to brave the darkness to try to correct the generator problem, the night is again filled with that reassuring hum, and the lights and rig are aglow once more. Moments later a friendly face pops through the door of the tent. "Sorry, ran out of gas—but you're all set now." Grumbling at the lost time, you return to the earphones and continue the search for the next field day contact, while your very own personal utility hums on in the night under the watchful eye of—Say! Who was that masked man?

While The Rest Sleep

Saturday morning, 6 AM. The alarm clock screeches its soul-rending announcement that rousts the volunteer out of bed on this weekend day. He showers and dresses quietly (doesn't want to wake the family), then begins loading the car with banners, boxes, and a large coffee urn.

6:45 AM. He pulls out and heads for the center, stopping at the all-night donut shop *en route*. A box of three dozen assorted donuts goes onto the pile in the front seat as he rolls on to his destination. After arriving at the test site, he unlocks the building, pops on the lights, gets the coffee going, lays out the donuts, and attends to the myriad of other mini-tasks that takes up three quarters of an hour in an instant...

"Say! Who was that masked man?"

7:30 AM. The first of the VEs arrive, grateful for the coffee and donuts, and thoroughly preoccupied with the coming exams. The volunteer helps unload the material, and then returns to his corner of the kitchen to keep the coffee and donuts flowing.

"Tom, would you take the examiners another round of coffee?

"Sure, no problem!"

That Tom—what a super guy. Tom who?

Just the Newsletter

"Hi, honey, thought I'd call and see what we got in the mail."

"Not much," she replies, "just some magazines and the club newsletter, same old stuff we always get about this time of month."

The same old stuff...Well, friend, that club newsletter made it to your mailbox with the help of a volunteer who takes time out of his busy schedule once a month, licks many dozens of stamps, sticks them plus address labels to many dozens of newsletters, sorts the newsletters by zip code, and drives to the post office to mail them. Whoever does this *has* to be a volunteer—club dues often don't even cover the cost of the materials to produce the newsletter, much less printing them and preparing them for mailing! To this, many say: "Hey!! I pay my dues to the club, they owe me a newsletter," when it would be better to say: "Gee—I don't know who pitched in their time, but know I owe them some thanks!"

Hundreds More Like Them

These people are just a few of the many quiet selfless workers you find around every club who make it possible for the rest of the membership to enjoy themselves. These folk work hard to see that the wheels of club activity turn smoothly. Don't you think it's time to give them a pat on the back?

Show'em You Care!

Take a chance on looking foolish. Go to the next club board meeting, and tell the "movers and shakers" of your organization that it's time to pay tribute to the "greasers and easers" of the club, and let them know they're appreciated.

It's so easy to do! Practically every computer today has a graphics package for creating custom-designed certificates, and every club has at least one "guru" of graphic arts. Most stationery stores sell generic certificates of appreciation. Nicest of all, though, is the hand-lettered certificate.

Make up a list of recipients for this "appreciation award," make certificates one way or another, and have the president of the club sign them.

This year, as a proud member of one of the largest free public service groups in the world, let's let our fellow hams know that "who cares" refers to us! This year, as we enter the holiday season, let's sing for the unsung heroes. ■

Jack Parker K5CVD has been a ham since 1957. Other interests include fishing, camping, and community theater. You may reach him at PO Box 356, New Ellenton, South Carolina 29809-0356.

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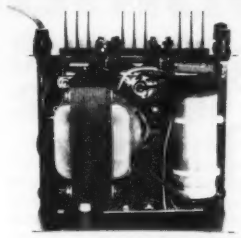

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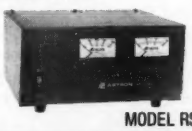
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

RS-A SERIES

MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7⅛	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

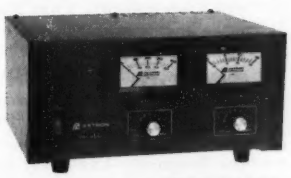
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES



MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Easy Tuning for the Uniden HR2510

For easier and safer 10 meter mobileering.

by Carl A. Kollar K3JML

If you were driving down the road and noticed the driver in the car in front of you leaning forward, to the right and down, and staying that way, wouldn't you naturally assume he got his fingers stuck in the heater vent? Many people who enjoy mobile hamming, however, also spend a lot of time in this position, if they are using the nifty little Uniden HR2510 10m mobile rig. On this rig, to tune meticulously from one end of the active SSB portion to the other takes a lot of knob twisting. At the same time, of course, they have to pay attention to their driving. There had to be a better way!

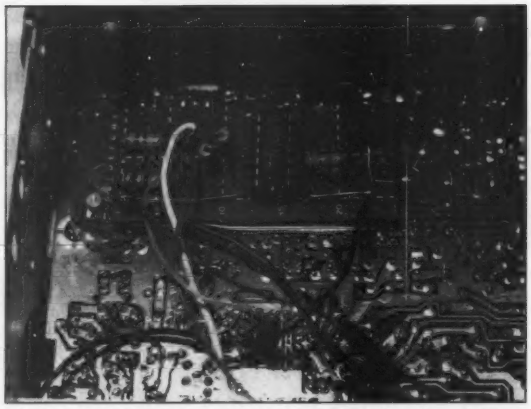


Photo A. Completed circuit built on a portion of perf board. There are only 10 components to install!

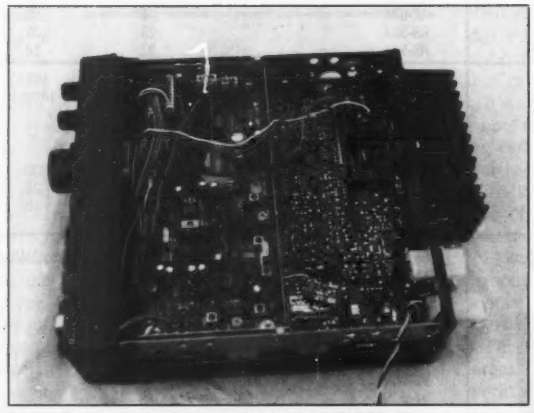


Photo B. Circuit board installed in the HR2510. There's plenty of room for easy mounting.

The Annoyances

The 2510 really is a nice little mobile rig, but some minor annoyances quickly become evident. (1) The up-down button on the mike QSYs in 10 kHz steps only. In my opinion, this makes it useless for fine-tuning the band for SSB stations. I can't think of any time this feature would be useful. (2) It has no offset for 10 meter operation. (3) The receiver RIT control has no disable; you can call stations until you're blue in the face, and not get an answer because you're on different receive and transmit frequencies.

I understand the new HR2600 corrects all these "problems," and that's great, but what if you don't want to go through the hassle of selling your rig and spending more money to get the newer model? The April 1989 issue of *73* features an article by WB9WDH and WA9QDZ called "FM Split for the Uniden HR2510," which pretty well takes care of the repeater offset problem. And, although I haven't seen it yet, I understand there's also a mod that takes care of the receiver RIT problem.

Tuning from the Mike

I needed a nice little mod that would give me useful up-down buttons on my microphone. When you're normally tuning with the front panel knob, you can select 0.1 kHz, 1 kHz, or 10 kHz tuning increments with the span button. The 100 Hz position is the most useful in tuning SSB signals. I needed to make the radio "think" it was receiving its directions from the front panel frequency control, when in actuality it was receiving from the mike buttons.

The first step was to investigate what kind of "signal" the up-down buttons on the mike supplied to the radio. A little investigation found that an "up" depression put a ground on the black mike wire, while a "down" depression put a ground on the white mike wire.

The next question was: What kind of indication from the frequency knob on the front panel did the transceiver need to change frequency up or down? Some physical lead following lead to jack J307 on the main circuit board. (See Figure 1.) A little scope probing soon revealed that for an "up" command, a positive going pulse was needed on J307-3, and for a "down" command, a positive pulse was needed on both J307-2 and J307-3.

Furthermore, these points could be pulled high by an external source to effect the frequency change. They weren't a solid low when not activated, just at ground potential (probably held there by pull-down resistors). I was able to make the frequency change by manually jumping +5V with a wire to these points, just as if I were using the front panel knob. Also, since the radio "thought" that it was receiving its instructions from the frequency knob, the span switch was still effective in determining the tuning increments.

So, there I had it—all the elements I needed to design my circuit. I needed an interface which would intercept the up-down mike switch depressions, create a pulse train for easy tuning, and route those pulses to the appropriate points to continuously tune the

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12-Band, 200 Channel • 800 MHz. Handheld Search • Limit • Hold • Priority • Lockout
Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The *Bearcat* 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the **BC 100XLT-T** for only $189.95. Includes antenna, carrying case with belt loop, ni-cad battery pack, AC adapter and earphone. Order your scanner now.

Bearcat® 800XLT-T2

List price $549.95/**CE price $239.95/SPECIAL**
12-Band, 40 Channel • No-crystal scanner Priority control • Search/Scan • AC/DC
Bands: 29-54, 118-174, 406-512, 806-912 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz.
The Uniden 800XLT receives 40 channels in two banks. Scans 15 channels per second. Size 9¾" x 4½" x 12½." If you do not need the 800 MHz. band, a similar model called the **BC 210XLT-T** is available for $178.95.

Bearcat® 145XL-T

List price $189.95/**CE price $94.95/SPECIAL**
10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC
Bands: 29-54, 136-174, 406-512 MHz.
The *Bearcat* 145XL is a 16 channel, programmable scanner covering ten frequency bands. The unit features a built-in delay function that adds a three second delay on all channels to prevent missed transmissions. A mobile version called the **BC560XLT-T** featuring priority, weather search, channel lockout and more is available for $94.95. CEI's package price includes mobile mounting bracket and mobile power cord.

President® HR2510-T

List price $499.95/**CE price $239.95/SPECIAL**
10 Meter Mobile Transceiver • Digital VFO Full Band Coverage • All-Mode Operation Backlit liquid crystal display • Auto Squelch RIT • Preprogrammed 10 KHz. Channels
Frequency Coverage: 28.0000 MHz. to 29.6999 MHz.
The *President* HR2510 Mobile 10 Meter Transceiver made by Uniden, has everything you need for amateur radio communications. Up to 25 Watt PEP USB/LSB and 25 Watt CW mode. Noise Blanker. PA mode. Digital VFO. Built-in S/RF/MOD/SWR meter. Channel switch on the microphone, and much more! The HR2510 lets you operate AM, FM, USB, LSB or CW. The digitally synthesized frequency control gives you maximum stability and you may choose either pre-programmed 10 KHz. channel steps, or use the built-in VFO for steps down to 100 Hz. There's also RIT (Receiver Incremental Tuning) to give you perfectly tuned signals. With receive scanning, you can scan 50 channels in any one of four band segments to find out where the action is. Order your HR2510 from CEI today.

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List price $599.95/**CE price $299.95/SPECIAL**
10 Meter Mobile Transceiver • New Features
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R2066-T *Regency* 60 channel scanner.....$149.95
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CIRCLE 121 ON READER SERVICE CARD

radio from the mike, just by holding the button down. The result of that design is shown in Figure 2.

Circuit Workings

The 4001 is a CMOS quad 2 input NOR gate. On any one gate, with either or both input high, the output is low; with both inputs low, the output is high. Sections A and B are configured as an astable multivibrator to generate the clock pulses needed to eliminate the need to depress the mike button for each tuning increment.

The rate at which the tuning takes place (clock frequency) is determined by the 0.1 µF capacitor and the 470k resistor. The 4.7 megohm input resistor is generally 10 times the value of the timing resistor, and contributes to 50% duty cycle as well as independence of the clock frequency from supply voltage variations. With the values shown, you get about 2 pulses per second, apparently a comfortable tuning rate. You can fine tune SSB signals without overshooting the target frequency or tuning too slowly.

The output of the multivibrator (pin 4) is fed to pins 12 and 8 of the other 4001 sections, which are used as gated inverters. (The gating is what we're after; the inverting has no serious consequences for our application). At this point, the pulse train goes nowhere until one of the other gate leads is grounded (ultimately by either the up or down mike button). If the "up" mike button is pressed, pin 13 of section C is grounded, and a pulse train is output from pin 11 through the 1k isolation resistor to the white wire on J307, causing the HR2510 to increment one digit per pulse.

If the "down" button is pressed, a ground is placed on pin 9 or section D of the 4001. Also, the diode between pins 13 and 9 become forward-biased and applies a near-ground on pin 13 of section C. This causes a pulse train at both pins 10 and 11, through the isolation resistors and on to the white and gray wires on J307. This, in turn, causes the HR2510 to decrement one digit per pulse for as long as the button is held down. The circuit is simple, but it serves very well as the interface to accomplish our purpose.

Building the Circuit

My prototype was built on a portion of perf board with a pad-per-hole configuration purchased from Radio Shack. The component count (10) is so low, I didn't take time to try to design and etch a printed circuit board. It took me half an hour to build the circuit (see Photo A). Fabricating a PCB would have taken longer than that.

Using the layout shown in Figure 3, mount the components. In most cases, you can make connections using the extra length of the component leads. For those of you who are using the Radio Shack circuit board, the Component Mounting Guide table may help. After placing the parts (as shown in solid lines), and

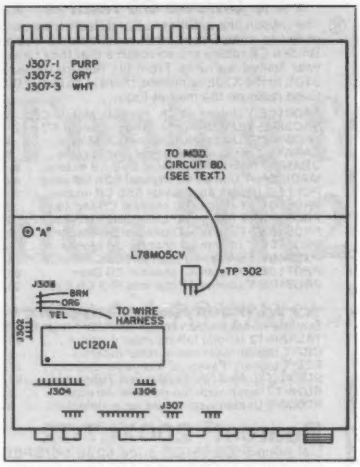

Figure 1. The opened HR2510. Front panel faces down.

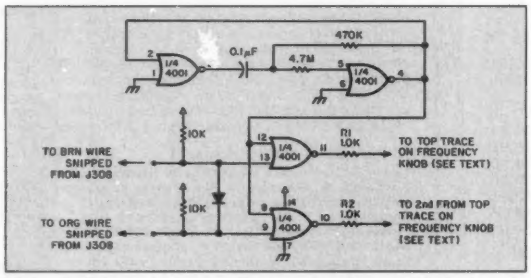

Figure 2. Schematic for the mike tuner interface, which fits into the HR2510.

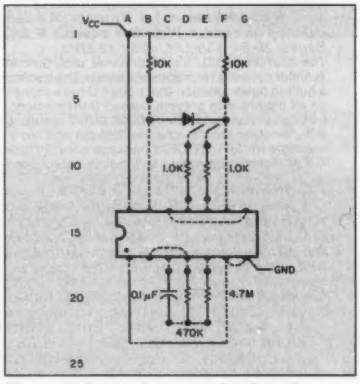

Figure 3. Parts placement for the mike tuner interface.

the wires underneath (in broken lines), make the proper connections.

Refer to the perfboard in Photo A. The 1k resistors between D8 and D12 have leads going into D8, then pulled up through D7 to connect to the HR2510. The same goes for the 1k resistor between E8 and E12. Pull the lead down through E7 and then back up through E8. When the circuit is built, cut off the excess board along row 25 and column J.

Cut six 12-inch lengths of wire. Attach a red wire to A1 on the circuit board (wire from IC pin 14) and a black wire to A3 on the circuit board (wire to pin 1 on the IC). These are your positive and negative supply leads respectively. Connect another wire to the resistor end looped through D8 and D7, and another to the resistor end looped through E8 and E7.

Finally, carefully solder a wire to the anode of the diode (location B6, or even better, the resistor lead at B5) and another to the cathode (location F6, or even better, to the resistor lead at F5). Temporarily, set the board aside.

Installation

With the front panel facing you, and the bottom cover facing up, (the side with the speaker), remove the four side screws holding the cover. Carefully remove the bottom cover, paying particular attention to the wires still attached to the speaker mounted on the cover.

I found it convenient to unsolder the speaker wires and set the bottom cover aside. You can see that there is plenty of room in the rear half of the radio for extra goodies. Press two layers of double stick tape to the bottom of your board, then press it firmly onto the HR2510 circuit board in the left rear corner (see Photo B).

Attach the six wires coming from the circuit board as follows:

1. The ground wire of your circuit board (IC pin 1,6,7, etc.) is routed along the left edge of the chassis and fastened under the screw at point A. (Figure 1)

2. The voltage supply wire (IC pin 14, etc.) is routed toward the center and to the L78MO5CV regulator. Carefully solder to the right hand lead as shown in Figure 1.

3. The lead coming from location D7 (the resistor R1 connected to pin 11 of the IC) is carefully routed down the center and toward the frequency knob. Carefully solder to the top trace on the frequency control circuit board. This is the trace with the white wire attached to it.

4. The lead coming from location E7 (the resistor R2 connected to pin 10 of the IC) is carefully routed down the center and toward the frequency knob and soldered to the next trace down on the frequency control circuit board. This trace has a gray wire attached to it.

5. Refer to Figure 1 and locate J308 with the brown, orange and yellow wires attached. About 1 inch from the connector, cut the brown and orange wires. This will allow easy restoration of the HR2510 to its original configuration.

6. Connect the wire coming from the anode of the diode on your circuit board (location B6 or B5) to the longer brown lead going into the harness snipped from J308. Connect the wire coming from the cathode of the diode (location F6 or F5) to the longer orange lead going into the harness snipped from J308.

7. Installation is now complete. Inspect all wiring before applying power.

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If you think that this is good, wait until you try it while you're driving!

Conclusion

This project is easy. With the proper care, it should go very smoothly. From start to finish, it should take about 2 hours. It's worth the effort and sure beats selling the whole rig to buy the upgraded version.

If you're a little squeamish about messing around inside your rig, you can send it to me *insured* with a check for $50.00 to cover parts, labor, and return shipping. I'll be happy to modify it and return it within a week of when I get it. Just remember, if it's in warranty, this mod will void your warranty.

Enjoy the easy tuning, and see you on 10m! 73

Carl A. Kollar K3JML, 1202 Gemini St., Nanticoke PA 18634.

Parts List

Qty	Description	Radio Shack Part #	Price
2	10kΩ ¼ W resistor	271-1335	.39, pkg. of 5
1	1N914 diode	276-1122	.99, pkg. of 10
2	1kΩ ¼ W resistor	271-1321	.39, pkg. of 5
1	14 pin IC socket	276-1999	.89
1	0.1µF 50 V capacitor	272-135	.59, pkg. of 2
1	470k ¼ W resistor	271-1354	.39, pkg. of 5
1	4.7M ¼ W resistor	Local TV repair shop	
1	4001 CMOS IC	276-2401	.99
1	project board	276-158A	2.29
1	high bond double stick tape	64-2361	1.99, pkg. of 2

Component Mounting Guide on Radio Shack PCB

Component	Mounting Points
10k resistor	B1 to B5
10k resistor	F1 to F5
1N914 diode	B6 to F6
1k resistor	*D8 and D7 to D12
1k resistor	*E8 and E7 to E12
IC socket, pins 14 to 8	A13 to G13
IC socket pins 1 to 7	A16 to G16
Jumper wire	A17 to A23
Jumper wire	B23 to F23
Jumper wire	A1 to A12
0.1 µF capacitor	C17 to C21
470k resistor	D17 to D21
4.7M resistor	E17 to E21

*See text

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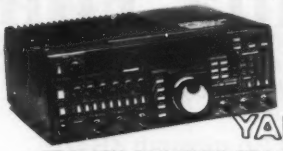

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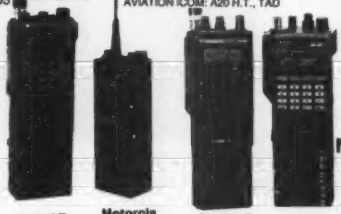

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Three-In-One Antenna Tuner

Matches virtually any random wire!

by J. Frank Brumbaugh KB4ZGC

Operating your rig on Field Day, or under severe conditions following a natural disaster, often requires using less than optimum antennas. Tuning these antennas of unknown characteristics may be more than your present antenna tuner can handle, and result in too high a standing wave ratio (SWR), a condition solid state rigs abhor.

Because Field Day and emergency operation is usually low power, you can put together this tuner from parts in most junk boxes. Assuming a maximum of approximately 50 watts output, the capacitors can be anything from 100 pF to 365 pF broadcast receiver types. The inductance is a tapped coil, and may be a piece of miniductor, a toroid such as a T106-2, or a surplus rotary inductor. For such low power, standard or miniature wafer switches work fine.

Antenna Tuner Circuits

To make this tuner as versatile as possible, yet simple to construct from junk box parts, I included three standard antenna tuning circuits capable of handling just about any odd piece of wire you may have to use, as well as more standard antennas. A 4P3-position wafer switch chooses each of the three tuner circuits available. These are designated A, B, and C, as illustrated in Figure 1.

Circuit A will tune random wires with a relatively high impedance at the input. Circuit B tunes random wires with a low impedance input, such as a quarter-wavelength at the operating frequency. Circuit C is the standard T-configuration used in many commercial antenna tuners. It will feed coax feeders, twinlead, or single wires of a wide range of impedances.

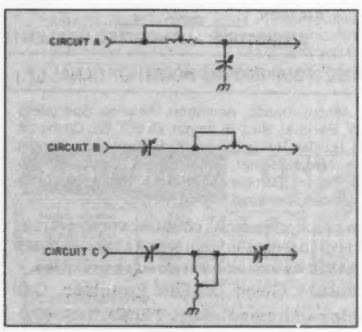

Figure 1.

Photo A. Front panel of the three-in-one tuner.

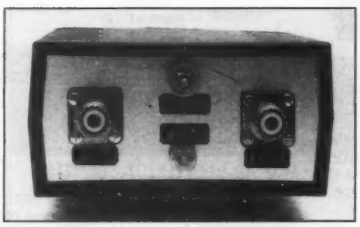

Photo B. Back panel and bottom inside view of the three-in-one tuner. Wire lengths are not critical, since the tuner handles only HF frequencies.

Figure 2 shows the tuner circuit. Switch S_1 is a 4P3-position miniature wafer switch which chooses the tuner circuit required by the antenna. C_1 is active only in circuits B and C. C_2 is active only in circuits A and C. The tapped coil is active in all three circuits.

Operation

Working the tuner couldn't be simpler. One of the three available circuits will tune just about anything in the nature of an antenna you happen to want to use. Simply set the capacitor(s) at midrange, choose the tuner circuit you think will give the best results, apply power, and adjust the coil tap switch S_2 and capacitor(s) for minimum SWR. If you cannot reduce SWR to less than 2:1, try a different circuit with S_1 and retune as described above. Just take care to never switch it with RF applied to the tuner, except for the coil tap switch.

Parts

Although most hams will probably have all the parts necessary in their junk boxes, for those who may need something, I suggest swapping with another ham, or visiting flea markets or hamfests.

Tuning capacitors are available from: Small Parts Center, 6818 Meese Drive, Lansing MI 48911; Fair Radio Sales, PO Box 1105, Lima OH 45802; and BCD Electro, PO Box 830119, Richardson TX 75083. Other mailorder dealers carry them at reasonable prices. T106-2 toroids are available from Small Parts Center, and from Amidon Associates, 12033 Otsego St., North Hollywood CA 91607. Wafer switches are available from these sources and many others.

You can construct this tuner in just a few hours. You don't have to build it in a box, but you can. Cabinets which accomodate this tuner are readily available from Radio Shack and a few surplus dealers, such as Fair Radio Sales. Because the capacitor rotors must be insulated from ground, you may wish to construct it on a wood or Masonite panel. If you do much experimenting with antennas, you will find this tuner extremely handy. And it will be priceless on your next Field Day outing as well as serving under adverse conditions in emergencies. 73

J. Frank Brumbaugh KB4ZGC, 82 Liddell Street, Buffalo NY 14212-1824.

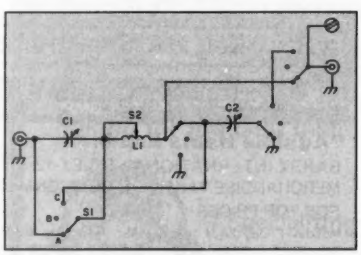

Figure 2. Three-in-One antenna tuner schematic. This circuit combines the three circuits of Figure 1.

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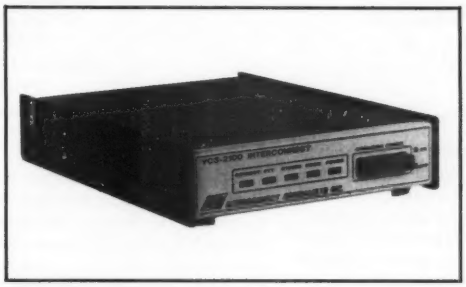

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- **MOBILE ACTIVITY TIMER**
  Causes disconnect if mobile drives out of range. Can be set to 30, 45, 60, or 90 seconds.
- **TOLL RESTRICT**
  The first digit dialed cannot be a "1" or a "0". Rearms after dialing is complete.
- **PHONE LINE IN USE INHIBIT**
  Prevents interrupting a call when the patch shares the telephone line with a telephone.
- **TOLL RESTRICT DEFEAT CODE**
  A special programmable code allows toll calls. Also allows access to line, even if line is in use.
- **TONE OR PULSE DIALING**
  Switch programmable for Tone or Pulse dialing. Pulse dialing can be used on a tone line.
- **HALF DUPLEX MODE**
  The VCS-2100 can be used as a repeater interconnect in this mode.

Kenwood Compatability with VCS-2100. All connections, required for installation are available at the MIC. connector on most late model Kenwood Transceivers. Interface cables are available from I.S.I.

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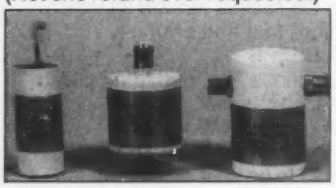

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83-822	PL-259 Teflon, Amphenol	1.75
PL-259/ST	UHF Male Silver Teflon, USA	1.50
UG-175	Reducer for RG-58	.20
UG-176	Reducer for RG-59 & MINI 8	.20
UG-21D/U	N Male RG-8, 213, 214, Delta	3.25
UG-21B/U	N Male RG-8, 213, 214, Kings	5.00
9913/PIN	N Male Pin for 9913, 9086, 8214 fits UG-21D/U & UG-21B/U N's	1.50
UG-21D/9913	N Male for RG-8 with 9913 Pin	3.95
UG-21B/9913	N Male for RG-8 with 9913 Pin	5.75
UG-146A/U	N Male to SO-239, Teflon USA	6.00
UG-83B/U	N Female to PL-259, Teflon USA	6.00

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73 Review *by Larry R. Antonuk WB9RRT*

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The FCC doesn't issue it, but somewhere between Tech and General most hams get a "Mr. Fixit" license. Like the old commercial ticket, this license has various endorsements—ranging from "Flashlights and Floorlamps" all the way up to the coveted "Anything That Plugs Into The Wall."

Luckily, most of us have the basics. A meter's a meter, and the 'scope that fixes your packet rig works just as well on an AM/FM car radio. But what about some of the more mechanical stuff? Can I fix a washing machine with an oscilloscope?

No, not really. You don't need to. As it turns out, most of the professionals who do home appliance repair use just a few instruments: A DVM, a test fixture or two for specialized cases, and an AC current probe.

The Essential Tool—Affordable

A what? A current probe. A current probe is simply a device that measures AC current. Most of us are familiar with current measurements—you open one side of the circuit, insert your meter, and power up. Unfortunately, spreading wires on the floor in series with your meter isn't always practical when dealing with 120 or 240 VAC. In addition, most meters have a maximum input of ten amps, making them unsuitable for most major appliances. The current probe was developed with the idea of reading current in the range of one hundred amps or so, with the benefit of not needing to break one leg of the circuit.

Until recently, clamp-on current probes have always been expensive. Several months ago, however, I came across the newly released ST-265 AC Clamp-On Current Adapter from Elenco. This device, which performs precision current measurements from 0 to 1000 amperes at 60 Hz, retails for under $35. The low price reflects the fact that the unit is an adapter, not a complete unit in itself. Just plug the ST-265 into any high impedance DVM, switch to a millivolt scale, and read the current directly from the display (one millivolt equals one amp). The Current Adapter has a basic accuracy of 2.5% of the reading, ± 4 digits. (If precise accuracy is necessary, note that the accuracy of your DVM needs to be figured in as well.)

Using the Current Probe

Putting the ST-265 to work couldn't be simpler. You don't need to physically connect it to a conductor to measure the current passing through it. It senses the current flow by induction. This means you don't have to go through the hassle of trying to place the probe on a connection point (often recessed to keep it away from straying fingers), or stripping off conductor insulation and taping it over after measuring.

For instance, in the case of a stalled washing machine motor, you clamp the Adapter around one of the power leads and read the current. Mechanically disconnecting the motor from the transmission and taking another reading will indicate either a defective transmission or a defect in the motor, such as a shorted winding or dry bearings. Once things are corrected, you can easily check the start and run currents. Consider an intermittent circuit breaker in the house wiring. Is the breaker bad, or is the load approaching the rating of the breaker? The ST-265 can tell you in a second. How much does it cost to run that kilowatt amplifier? Just measure the current, convert to power, find out the local electrical rates, and, well, uh, . . . never mind.

Addictive

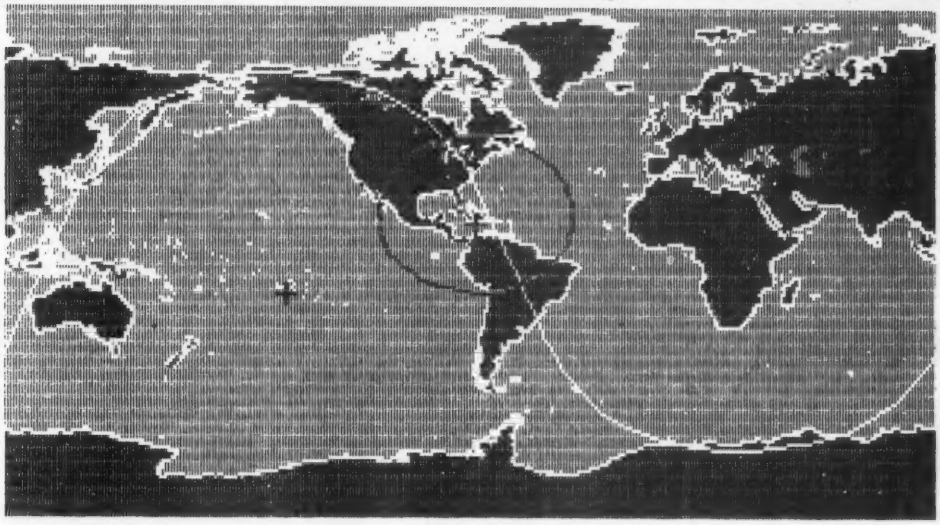
Perhaps the only drawback to the ST-265 Current Adapter is that it can be too much fun to use. The tech is often seen running around the house with his Current Adapter and calculator, saying things like: "Hey! Turn that off! Don't you know that hair dryer costs 10.277 cents per hour to run?? Go watch TV! That's only 2.345 cents!!" After a couple of nights of this, the family firmly escorts the would-be technician downstairs to his shop.

"And while you're down there, take a look at that broken washing machine!" 73

Larry Antonuk WB9RRT has written numerous reviews on test equipment and electronics books for 73 Magazine. He currently works as a project manager for a land mobile service shop in Keene, New Hampshire. He enjoys home-brew projects, experimentation, and instrumentation. Contact him at PO Box 452, Marlborough NH 03455.

Satellite Tracking

with your PC and the Kansas City Tracker & Tuner



The **Kansas City Tracker** is a hardware and software package that connects between your rotor controller and an IBM XT, AT, or clone. It controls your antenna array, letting your PC track any satellite or orbital body. The **Kansas City Tracker** hardware consists of a half-size interface card that plugs into your PC. It can be connected directly to Kenpro 5400A/5600A or Yaesu G5400B/G5600B rotor controllers. It can be connected to other rotor assemblies using our Rotor Interface Option.

The **Kansas City Tuner** Option provides automatic doppler-shift compensation for digital satellite work. The **Tuner** is compatible with most rigs including Yaesu, Kenwood, and ICOM. It controls your radio thru the radio's serial computer port (if present) or through the radio's up/down mic-click interface. The **Kansas City Tuner** Option is perfect for low-orbit digital satellites like the NOAA and Microsat satellites.

The **Kansas City Tracker** and **Tuner** include custom serial interfaces and do not use your computer's valuable COMM ports. The software runs in your PC's "spare time," letting you run other programs at the same time.

The **Kansas City Tracker** and **Tuner** programs are "Terminate-and-Stay-Resident" programs that attach themselves to DOS and disappear. You can run other DOS programs while your antenna tracks its target and your radios are tuned under computer control. This unique feature is especially useful for digital satellite work; a communications program like PROCOMM can be run while the PC aims your antennas and tunes your radios in its spare time. Status pop-up windows allow the user to review and change current and upcoming radio and antenna parameters. The KC Tracker is compatible with DOS 2.00 or higher.

Satellite and EME Work

The **Kansas City Tracker** and **Kansas City Tuner** are fully compatible with N4HY's QUIKTRAK and with Silicon Solution's GRAFTRAK. These programs can be used to load the **Kansas City Tracker's** tables with more than 50 satellite passes.

DX, Contests, and Nets

Working DX or contests and need three hands? Use the **Kansas City Tracker** pop-up to work your antenna rotor for you. The **Kansas City Tracker** is compatible with all DX logging programs. A special callsign aiming program is included for working nets.

Packet BBS

The **Kansas City Tracker** comes complete with special control programs that allow the packet BBS user or control-op to perform automated antenna aiming over an hour, a day, or a week. Your BBS or packet station can be programmed to automatically solicit mail from remote packet sites.

Vision-Impaired Hams

The **Kansas City Tracker** has a special morse-code sender section that will announce the rotor position and status automatically or on request. The speed and spacing of the code are adjustable

The **Kansas City Tracker** and **Tuner** packages include the PC interface card, interface connector, software diskette, and instructions. Each Kansas City unit carries a one year warranty.

- KC Tracker package for the Yaesu/Kenpro 5400A/5600A controller $189
- Interface cable for Yaesu/Kenpro 5400A/5600A ..... $ 19
- Rotor Interface Option (to connect to ANY rotors) ..... $ 30
- KC Tuner Option ..... $ 79
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CIRCLE 9 ON READER SERVICE CARD

Continued from p. 22

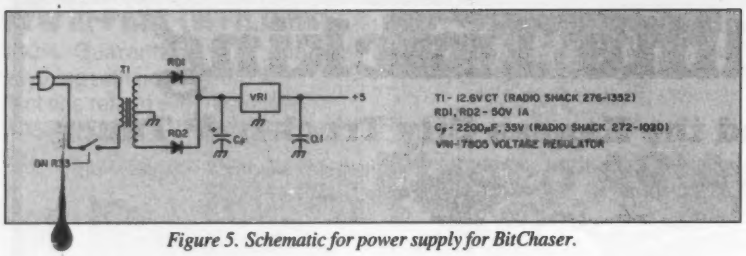

Figure 5. Schematic for power supply for BitChaser.

lengthen it to 40 bits (add another 74164 shift register), or use 4-bar graph chips, but leave the last eight bits unused.

Whichever method you choose, align the diodes as carefully as possible when you solder them in place, otherwise the display will ripple as the lighted areas move across the display.

Layout Design

With some clever board layout, you can minimize the number of interconnects and wires between the shift registers, the LEDs, and their current-limiting resistors. For example, you can put the resistors on either the power supply side or the IC side of the LEDs, and use the resistors themselves as the interconnecting wires, saving 32 pieces of wire and 64 solder connections!

Exact parts placement and board layout depends on what kind of a case you use. I used a junked Heathkit FET VOM case, with the board mounted vertically behind the front panel, and the LEDs in a window where the meter used to be, leaving room for the various switches and other controls on the right side. The crystal and variable clocks are mounted on a small board attached to one end of the case. (The PC board shown in the parts list has plenty of room for the entire circuit of the BC, without using sub-boards; the photos show what I had in the junk box at the time.)

The power transformer, rectifier, and regulator are mounted on the back of the case. Point-to-point wiring was used throughout, and no PC foil patterns are available at this time. A toggle switch near the bottom center of the front panel, originally meant to be the power switch, is unused, as the pot selected for the Scan Delay control happened to have a switch. Two strips of red plastic cover the LED display string and the two 7-segment displays just above the LEDs. I used small pieces of PC board to mask off the rest of the original meter hole in the VOM case.

Exactly what panel arrangement you use depends on the case and circuit board you pick. The same is true for exact parts placement on the circuit board; the parts placement is not critical and should have no effect on operation. Just use normal TTL construction practices, like liberally bypassing supply lines with .1μF capacitors.

Instead of using the relatively large PC board in the parts list, you might consider three smaller boards, one for the clock and divider circuits, one for the control logic and counters, and one for the shift registers and LEDs. This may make construction and panel layout easier. Again, there is nothing critical in the circuitry layout—just put things where they are convenient, and group the controls and jacks in a logical way for ease of use.

Using the BitChaser

The prime operating mode, for which the unit was originally designed, is the Sync Start/Clocked Stop mode, used for capturing and displaying pulses that are (or are not!) supposed to be on a particular line. This is especially useful for trapping glitches, which are generally shorter than valid data.

With an External Start signal, you can easily measure the time before another event occurs, such as an acknowledgment from a circuit controlled by a computer output signal. With both an External Start and Stop, you can see what happened on a third line in the time between two those signals. Note that the External Start or Stop requires *negative-going* (high-to-low) transitions to work properly.

You can use the internal calibrated and variable clocks as general-purpose TTL square-wave sources. The BC works as a frequency counter up to about 2 MHz, if you are interested only in regular, repeating signals, and you're willing to do the simple division to convert "period" to "frequency." Again, however, the unit as shown will only work on TTL signals; to count sinewaves or signals at other voltage levels, you will need some sort of external translation/squaring circuits.

As a signal generator, the ability to program in any conceivable bit pattern, then play it out once, or continuously, and at any of several calibrated or adjustable bit rates, provides a very flexible test generator. Finally, if you insist on using that oscilloscope, you can capture some data, go into the recycle mode, attach the scope to the signal-out jack, adjust the scope sweep, and you've got a storage scope!

For The Future...

Another feature I considered, and may back-fit some day, is a shift register hidden in the recirculate loop. It would be a relatively long register (64 bits), but have no LEDs. It would allow for much longer data capture periods, then you would use the recirculate mode to cycle it through the registers that do have the LEDs.

If you add a shift register, you will need eight 74164s (or 74LS164s, to avoid overloading the clock signal), and some sort of decoder to detect a count of 96 in the clock counters, to stop the clock. Note that with 96 bits total, you can actually program in your callsign in ASCII, Baudot, or Morse, and use the BC as a triggered or repeating callsign generator. If you include this option, I strongly suggest that you retain the 7-segment displays, so you can tell where you are in the hidden/displayed bit pattern.

Happy bit-chasing! 73

Ron Cole K4OND was first licensed in 1960. He has a B.Sc. in Physics and an M.S. in Information Systems Management. Besides ham radio, his interests include computers and horses. He is now stationed in Washington, D.C., as a Captain in the US Navy. You may reach him at Apt. 709, 1111 Arlington Blvd., Arlington VA 22209.

Parts List

Part	Description	Cost Total Quantity
IC1, IC13	7400 Quad NAND	$ .38
IC2–IC5	74164 8-bit SIPO shift registers	3.40
IC6	7474 RS flip-flop	.32
IC7	7410 Triple 3-in NAND	.18
IC8, IC9	74192 BCD counters	1.50
IC10, IC11	7447 BCD to 7-Seg, JDR Microdevices	1.88
IC12	555 timer	.90
IC14	7473 JK Flip-flop	.35
IC15–IC18	7490 BCD counters	1.56
IC18	556 Dual timer	1.25
D1–D32	Subminiature discrete LED	4.00
S1–S3	SPDT Toggle, RS 276-603	4.68
S4	1P12T rotary switch, RS 275-613	1.39
S5–S7	N.O. push switch, RS 275-1547	2.69
S8	1P3T rotary switch, RS 275-1386	1.39
R33	1 megohm pot, with switch, RS 271-211	1.78
R34	10kΩ pot, linear taper, RS 271-1715	1.09
C1, C4	10 μF electrolytic, SSS	.80
C2	0.47 μF, SSS (5/$1)	1.00
C3	0.01 μF, RS 272-131	.49
Y1	4.000 MHz crystal, JDR Microdevices	1.95
F1, F2	7-segment display, RS 276-075	2.58
T1	12V center tap transformer RS 276-1352	5.79
RD1, RD2	50V 1A rectifier diode	.20
Cf	2200 μF 16V JDR Microdevices	.70
Reg	7805 voltage reg +5V, 1 amp	.30
Resistors	6 pull-up 2.2kΩ	.60
C5–C9	blocking cap 0.1 μF, SSS 10/$1	1.00
J1–J5	BNC panel jack, RS 278-105	6.95
R1–R32, R35–R48	330Ω ¼-W, RS 271-1315	3.90
DR1, DR2	switching diode 1N914 or equiv.	.20
XR1	xtal osc resistor 1.8kΩ ¼-W, RS	.19
XR2	xtal osc resistor 560Ω ¼-W, RS	.19
XC1	xtal osc capacitor 20 pF, RS	.39
Case	LMB, etc., size to fit PC board below	7.00
IC board	RS 276-191, 4.5" x 9.5"	5.46
Red Plastic	display cover/light filter	.50
	Total	$68.93

RS refers to Radio Shack; SSS to Solid State Sales, PO Box 74D, Somerville MA 02143, (617) 547–7053, ORDER (800) 343–5230.

If you can't find a case large enough for the circuit card, you can use two or three smaller boards, and a Radio Shack case.

I know of no source for the red plastic filter to cover the display area. Radio Shack no longer sells it. I used a strip salvaged from an old digital clock.

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PACKET TALK

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We Missed You!

After a one-year hiatus, Packet Talk is back onto the scene! By way of re-entering the field, I became involved in helping to put last month's packet issue together (no small task). In any case, now, as before, your comments and suggestions are welcome! You can reach me at the above address, or via usenet or internet as brian@wb6rqn.uucp; or via packet bulletin board as wb6rqn@wa3znw; or on CompuServe as 73207,3064.

Broadcast Packet

If you spend any time on packet radio, you have probably used a bulletin board system at one time or another. If you look at what is stored on the BBS, you quickly notice that most of the messages are bulletins addressed to all@usa or the like. The bulletin boards are efficiently programmed to send bulletins between themselves once and only once. It doesn't work this way, however, for the end users. And that limitation has become a real problem for channel loading.

Imagine that there is a very busy BBS near you. This BBS regularly serves 100 users. A 5K bulletin arrives regarding a very interesting topic, and every user decides to read the bulletin. This means that this simple 5K bulletin will be transmitted over the air 100 times, once to each user. This equals 500K of data. At the equivalent data rate of 500 bits per second (you can't get actual 1200 baud throughput because of turnaround delays and the like), this would be 133 minutes of air time. At that rate, it's not long before there aren't enough hours in the day to handle the traffic. This begs the question: Is this really the best way to distribute bulletins? No!

Broadcast Protocol

Let's review the above more carefully. When the first user requests the bulletin, the BBS broadcasts the bulletin into the ether. If the other 99 users had their TNCs on and were capturing the data on disk, they would end up with their very own copy of the bulletin. Now all we need is a mechanism that will allow the few stations that didn't receive the entire bulletin to request retransmission of the parts they missed. Pretty simple, eh?

The key to making this work is a special broadcast protocol that would reside on top of AX.25. The protocol works by breaking the bulletin down into *segments*.

Each segment must identify the bulletin it belongs to and its position within the bulletin. There probably should be a field that identifies the type of bulletin so that each station stores only bulletins the operator is interested in. Also, the size of the bulletin should be indicated so that the computer can decide if there is room for the entire bulletin or not.

The Segment Header

The segment header might contain:

1. Bulletin ID.
2. Bulletin type.
3. Total number of octets (bytes) in the bulletin.
4. Command code.
5. Segment offset in octets (where this segment begins relative to the beginning of the bulletin).
6. Segment size.
7. Segment data (bulletin text).

The Bulletin ID is a string or number guaranteed to be different from any other Bulletin ID. The Bulletin type code indicates the general subject; for example, there could be a code for NTS traffic, a code for BBS sysops, etc. The total number of octets tells the receiver how long the entire bulletin will be. The receiver compares this value with the amount of segment data received to determine when the entire bulletin has been received.

The command code differentiates a bulletin transmission from a request from a receiver for retransmission of a segment. A zero (0) in the command means that a segment is being transmitted, and a one (1) indicates a request from a receiver to retransmit a segment. The segment offset tells where this segment begins relative to the beginning of the bulletin. If the bulletin sender is transmitting segments 200 octets long, the first segment would have an offset of 0, the second an offset of 200, the third an offset of 400, and so forth. The segment size tells how many octets are in the segment data.

Sending and Receiving

The sender sends the entire bulletin without stopping. The receivers copy as much of the bulletin as they receive while keeping track of any segments that they miss. After the sender is finished, it unkeys. Any receivers that need a segment (fill-in) then wait for a while before requesting the segment again. The request for a retransmission looks like a segment with no data. The bulletin ID is given and the command code is set to 1 (request for retransmission). The segment offset and the segment size tell the original sender which segment to re-send. If anyone else also needs that segment, and they hear the retransmission, and they will not need to request it again.

Since the bulletin ID is unique, the receiver can request a retransmission or fill-in much later, even if the sender has sent other bulletins in the meantime.

I would like to receive some feedback from the packet community about this protocol proposal. With the burgeoning packet activity on HF, VHF, UHF and above, there appears to be a significant need for reliable and efficient broadcast data distribution. Since this service could run on top of unconnected (UNPROTO) AX.25 packets which still provide error-free transmission, you could even distribute new computer software with it.

Networking Packages Revisited

First off, let's get the controversial duo out of the way. For those out of the know, Nord>< Link produces a shareware networking package—TheNet—which is virtually identical to NET/ROM, marketed for $60 per NET/ROM chip by Software 2000. Software 2000 has long been claiming that Nord>< Link has pirated their software, and Nord>< Link continues to stoutly deny the charge. This imbroglio shows no signs of abating or tending toward resolution.

If you're in the market for a packet networking package, *neither* NET/ROM nor TheNet may be your best choice. Listed below are software packages which are feature-competitive to NET/ROM, and yet are much cheaper because most are shareware. Although TheNet is also shareware, if Ron Raikes and Software 2000 hold the copyright on NET/ROM, they could conceivably bring a successful suit against any user of TheNet in the United States.

ROSE, TexNet, PC/Node, and KA9Q Net

The first alternative is the RATS Open System Environment (ROSE) switch. The ROSE switch is a ROM that plugs into a TNC and turns it into an X.25 packet switch. The drawback is that the ROSE switch isn't compatible with NET/ROM. On the other hand, it will perform the same function. Information on ROSE is available from Thomas A. Moulton W2VY, 9 Rosalie Avenue, Clifton NJ 07011.

> **"...neither *NET/ROM nor TheNet may be your best choice.*"**

TexNet, one of the cleanest packet networking packages, runs on a special Node Control Processor (NCP). It includes both low speed (1200 baud) and medium speed (9600 baud) ports. Like ROSE, TexNet uses its own set of protocols, so it is not NET/ROM compatible, either. To get information on TexNet, contact TPRS, PO Box 831566, Richardson, Texas 75083.

Another alternative, PC/Node, written by John Wiseman G8PBQ, runs on IBM-PC compatible computers and is fully NET/ROM compatible with multiple ports. PC/Node also supports a WØRLI or a WA7MBL BBS in the PC at the same time that PC/Node is running.

My personal favorite alternative to NET/ROM is the KA9Q Net program. Net is NET/ROM compatible, and it runs TCP/IP as well. Net runs on several types of computers, including the PC, the Commodore Amiga, the Atari 520, the Apple Macintosh, and just about every UNIX™ system. At this writing, Net was being ported to the AEA PS-186. Net is available on 5¼" disks from Tucson Amateur Packet Radio, Inc., PO Box 22888, Tucson, Arizona 85734. 73

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20 MTR receiver kit HR-2	40 MTR receiver kit HR-4	80 MTR receiver kit HR-8	Receiver case CHR
$24.95	$24.95	$24.95	$12.95

QRP TRANSMITTER KITS, 20, 40 & 80 METERS

Operate a mini ham shack. These little CW rigs are ideal mates to our 40 and 80 meter receivers. Features include smooth variable tuning, one watt output and excellent keying characteristics. Runs on 12 VDC and is VSWR protected. See how far you can stretch your signal with one of these mini rigs. Optional ABS cases are available.

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AIRCRAFT RECEIVER KIT

Hear exciting aircraft communications—picks up planes up to 100 miles away. Receives 110—136 MHz AM air band, varactor tuned superhet design with AGC, ceramic filter and adjustable squelch. Runs on 9V battery, 50 mw audio output, 1 μv sensitivity. Optional matching ABS plastic case lets you take it anywhere, features screened graphics and machined aluminum knobs for a real professional look. Compact—great for airshows or for just plain hanging around the airport.

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Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software, PC board, all necessary parts and full documentation.

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Receiver kit, LB-5 **$9.95**

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Sensitive microphone cartridge **$2.95**

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Extends the range of your present counter to 1.5 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1.5 GHz in, 1.5 MHz out • drives any counter.

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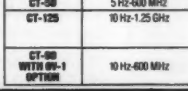
Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one year warranty on parts and labor. We take great pride in being the largest manufacturer of low cost counters in the entire USA. Compare specifications. Our counters are full featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry and durable high quality epoxy glass, plated-thru PC Board construction. All units are 100% manufactured in the USA.

CT-70 7 DIGIT 525 MHz



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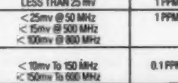
CT-90 9 DIGIT 600 MHz



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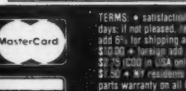
CT-50 8 DIGIT 600 MHz



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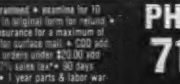
CT-125 9 DIGIT 1.2 GHz



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Telescopic whip antenna—BNC plug	$ 9.95
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Tilt bail for CT-70, 90 & 125	3.95
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CT-90	10 Hz-600 MHz	<10mv To 150 MHz <150mv To 600 MHz	1 PPM	9	0.1Hz, 10Hz, 100 Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	<25mv @ 50 MHz <15mv @ 500 MHz <100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH 09-1 OPTION	10 Hz-600 MHz	<10mv To 150 MHz <150mv To 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.95

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Winning Foxhunts with TDOA

My last column introduced you to Time Difference Of Arrival (TDOA) RDF methods. There, I described how a narrow aperture TDOA system uses two or more vertical antennas spaced less than a half wavelength apart. The relative differences in distance between each antenna and the transmitter cause phase differences in the signals into the receiver from the antennas.

Switching back and forth rapidly between the two antennas gives a superimposed tone on the discriminator output of an FM receiver due to these phase differences. A null in the amplitude of this tone occurs when the antennas are equidistant from the source; at that orientation the transmitter is in a direction perpendicular to the plane of the antennas.

A TDOA RDF set gives very sharp bearing indications, compared to the broad lobe of a yagi or quad. It's smaller than a beam for the same frequency, so it's easier to use on foot or mobile. You saw last time how easy it is to build the Handy Tracker, an effective TDOA RDF set for VHF. This month, we'll look at TDOA sets you can buy, complete or in kit form, and compare them to the Handy Tracker.

What's on the Market?

The first TDOA VHF RDF unit for ham radio was the Double Ducky, by David Geiser WA2ANU, described in *QST* over eight years ago. The Double Ducky is still available in kit form from Circuit Board Specialists for $27. Since then, similar units have come on the market. The Vector-Finder, introduced by Radio Engineers Company last year, is well packaged. It is intended primarily for boaters and includes a compass in its rather steep $125 price. The most recent entry is the Handy-Finder from North Olmsted Amateur Radio Depot. It just came out this summer, and is available in kit form for $25.

These three commercial TDOA units all give a very sharp line of bearing, but they have a basic problem. In many hunt situations, it's a fatal flaw. They have only a figure-8 pattern, which gives 180-degree bearing ambiguity. That's right, they give you two possible directions for the hidden transmitter, not one.

How do you tell which of the two figure-8 nulls is the one to follow?

The sellers of these units suggest that instead of walking or driving along the bearing line toward (or away from) the transmitter, you should move perpendicular to the line of bearing for a distance, then take another bearing and triangulate the two bearing lines on a map. They call this a "space diversity technique."

Space diversity works, but it's a very inefficient way to do transmitter hunting. You certainly wouldn't want to use that method when mileage or time is the criterion for winning the hunt. And if you were in an emergency situation, you wouldn't want to be waiting for someone to rescue you that way!

As a competitive hunter, I want to keep moving as directly as possible toward the fox at all times. I don't want to add mileage by jogging back and forth or circling in if I can avoid it. That's why I added a cardioid pattern mode on the Handy Tracker. The cardioid mode resolves the 180-degree ambiguity quickly, and that makes the Handy Tracker clearly a better RDF unit.

Photo A shows a 2 meter model of the Handy Tracker that uses a double-male BNC adapter to mount it directly on top of a hand-held transceiver or scanner. All parts are inside the shielded enclosure made of copper-clad board, except for the batteries. Two batteries are in clips on the bottom near the ends. This helps balance and stabilize the unit on the handie-talkie, and insures that a spare battery is available if needed. (Anybody want to talk about marketing it? Call me.)

"A TDOA RDF set gives very sharp bearing indications, compared to the broad lobe of a yagi or quad."

Left or Right?

Several experimenters have worked on ideas for resolving the figure-8 pattern ambiguity by adding visible or audible left-right indicators.

With them, you don't have to spin the unit and listen for the exact null in the superimposed tone. Instead, you turn the unit left when you get a left indication, and right when you get a right indication. At the exact left/right cross-over, you're aimed at the hidden transmitter.

The polarity of the pulses out of the FM receiver's discriminator stage gives left/right information, but it's tricky to extract it. I have tried some of these polarity extraction circuits, both published

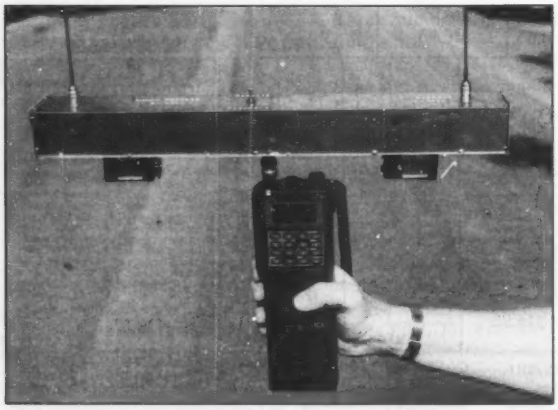

Photo A. This 2 meter version of the Handy Tracker fits right on top of a hand-held transceiver or scanner and can be rotated on the BNC connector to take bearings.

Photo B. Control panel of the SuperDF by BMG Engineering. WD6Y added these hoods to the LEDs on his unit to make them easier to see in bright sunlight, and drilled holes for access to internal controls.

Manufacturers of TDOA RDF Sets for Ham Radio

BMG Engineering Depot
9935 Garibaldi Ave.
Temple City CA 91780
(818) 285-6963

North Olmsted Amateur Radio
29460 Lorain Rd.
North Olmsted OH 44070
(216) 777-9460

Circuit Board Specialists
PO Box 969
Pueblo CO 81002
(719) 542-4525

Radio Engineers Company
3941 Mt. Brundage Ave.
San Diego CA 92111
(619) 565-1319

and unpublished. They usually work OK for hunting dead carriers, but if there is any modulation on the fox's signal, the indicator is not reliable or stops working altogether.

Fortunately, Russ Andrews K6BMG developed an indicator system, using synchronous detection, that works well even when the signal is modulated. Photo B shows his control box. In addition to LED indicators for left and right, there is a tone indicator mode. In that mode, the polarity sensing circuit forces the tone to make a noticeable change in pitch at

"The left/right indicators on the SuperDF make it easier and faster to use than any of the other TDOA RDF sets . . ."

cross-over. Low tone is a left turn indication and high tone is a right turn indication. The tone mode is easier to use while driving, and it saves battery power.

K6BMG sells his TDOA RDF set, called the SuperDF, in kit or wired form through his company, BMG Engineering. There are two antenna models, one for VHF (50–260 MHz) and one for UHF (100–550 MHz). Each uses vertical dipole antennas. Cost of a complete setup for use with your 2 meter receiver or transceiver is $135.60 for the control unit (kit price) plus $33.50 for the least expensive antenna set.

The left/right indicators on the SuperDF make it easier and faster to use than any of the other TDOA RDF sets, especially when the antenna and control unit are separated for hunting in a vehicle. If you have ever thought about T-hunting from a small airplane, consider mounting the two SuperDF antennas to the aircraft windows, keeping them a half wavelength or less apart. Then simply follow the left-right indications to fly right over the transmitter.

Another advantage of the SuperDF over the Handy Tracker is that the SuperDF works over a wide frequency range. BMG Engineering did tests demonstrating an accuracy of ±3.5 degrees from 110 to 260 MHz with one antenna set, when no reflections or multipath were present. The cardioid pattern mode of the Handy Tracker is limited to coverage of just one ham band, though you could add switching for additional lines to increase its range somewhat.

Field Evaluation of the SuperDF

The SuperDF is an excellent performer on vertically polarized signals.

K6BMG and I disagree, however, on its performance when the fox is horizontally polarized. Russ says he gets good horizontal performance by holding the unit overhead with the dipoles horizontal; he calls this the "pancake mode." I have tried this on competitive hunts, and I've also tried holding it out forward with the antennas at a 45-degree angle from vertical. Sometimes these positions gave good bearings on horizontal signals, but as often as not, they led me astray.

The synchronous detector must track the time delay of the FM receiver circuits. So unlike the Handy Tracker and other TDOA units, the SuperDF control unit may have to be readjusted when you're changing from one receiver to another receiver. This is no problem if you use it with only one radio, but it can be an annoyance if you use separate radios for vehicle hunting and on-foot sniffing.

You can have problems using the SuperDF if your receiver is not dead on-frequency, or if the IF and discriminator are out of alignment. Off-frequency signals produce distorted and sometimes inverted pulses. Thus, it's very important that the receiver be tuned exactly to the transmitter frequency for use with the SuperDF.

I have attempted to use the SuperDF with scanners for hunting outside the ham bands. Sometimes this worked well, but occasionally there were severe bearing errors caused by misalignment of the scanner or inability to set the scanner frequency to the exact transmitter frequency. Avoid the problem by testing your setup on a known signal source before looking for a hidden transmitter, performing receiver realignment if required.

I liked using the SuperDF in my initial tests, particularly for on-foot sniffing of low-power transmitters too weak for use with an amplitude-based sniffer. But I wished that it had a zero-center meter for left/right indication in addition to the two LEDs and the tone mode. The swing of a meter is easier for an experienced hunter to interpret in multipath than the flashing of lights. The meter also makes it quick and easy to peak the synchronous detector output when switching to a different receiver. So I taped a 1½-inch edgewise panel meter to the top of the SuperDF cabinet and used the circuit provided in the manual to drive it. If you have a SuperDF, give it a try.

Pitfalls of TDOA

All of the TDOA units are remarkably sensitive, but don't expect them to compete with a long yagi or quad when the signal is very weak. They are not the units of choice for starting the southern California 2 meter All-Day hunt, where the transmitter is typically 200 miles away. In severe multipath situations, they will be fooled, but you can usually still use them successfully if you keep moving and average out the readings. The slow response mode on the SuperDF is a big help in this regard.

I recently buried the transmitter on a Sunday afternoon hunt in an irrigation hole along the almost-green belt between the Santa Ana River and a row of bushes. Only the slim "rubber ducky" stuck out of the ground, camouflaged in a plant. Hunters with TDOA RDF sniffers would start at the riverbank, take a bearing, and then walk along the bearing line right over the transmitter into the bushes. When they didn't find it there, they'd step out, take another bearing, then walk the bearing line right over the transmitter again, onto the riverbank.

Without signal strength information, these hunters couldn't tell when they had reached the transmitter. Moral: Consider carrying along a field strength meter in addition to your TDOA sniffer so you can tell when you're very close to the fox. If you can't do that, stop much more often to take bearings and be sure you haven't gone too far.

A TDOA RDF set or sniffer is an important addition to your T-hunt arsenal. Take your pick, build or buy, then go out and find those hidden transmitters!

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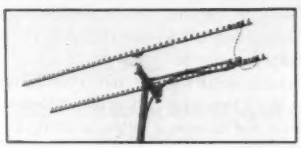

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Direct Conversion Receivers

Whenever two or more QRPers get together, the conversation turns to direct conversion (DC) receivers. I've mentioned these receivers before, and I've received a lot of mail on them, so this month we'll take a closer look.

What is a DC or "synchrodyne" receiver? In a DC receiver, a separate oscillator supplies the injection signal to the detector. The oscillator, in most cases, operates at the receiver's frequency. I call this oscillator the VFO, but some people call it the variable beat-frequency oscillator (VBFO). The VBFO replaces the tunable local oscillator used in superheterodyne receivers. The output of the VBFO is directly injected into the product detector. The product detector functions somewhat like the mixer in the superhet receiver.

How the DC Receiver Works

In most cases, and particularly on 80 and 40 meters, the incoming signal from the antenna is fed directly to the mixer. In better designs, the use of a tuned input will help in selectivity. We'll look a bit closer at this later on, but for now, let's just place the antenna directly to the mixer. The VBFO, or as I call it the plain 'ol simple VFO, is mixed with the incoming signal. This produces two outputs. Of the two outputs only one is within the audio range. The output is the sum and difference between the incoming signal and the VFO.

Look at it this way. Suppose you tune the VFO to 7040 MHz. Someone is calling CQ on 7041. The VFO and the incoming signals mix. The output is 1 kHz and 14081 kHz. The 14081 kHz is too high to use, and is filtered out. This leaves only the 1 kHz AUDIO note. This audio frequency is then amplified. At this stage, the DC receiver gets its gain, in the audio frequencies. Gain of over 100 dB have been used in DC receivers. In better designs, the use of audio filters provide the means of selectivity, or picking out the desired station.

It works quite simply. There are no IF frequencies or IF cans to mess with. The signal is mixed and the output is audio. Now for the bad news.

Tricky Tuning

Let's go back to our VFO sitting on 7040 MHz. Say the station we heard was on 7039 MHz; that station would also produce the SAME 1000 kHz tone. Now I don't know about you, but my ears can't tell the difference between two signals producing the same output from the mixer. This brings us to the biggest problem with DC receivers: lack of single signal reception. When tuning through the band, we heard TWO signals from each station. There are two signals on either side of zero beat, and nothing can eliminate this. Circuits attempting to avoid the problem soon become just as complex as the superhet receiver.

Since the DC receiver can't distinguish between the incoming signals, tuning for the correct one can be a real chore. There are, however, two basic "fixes." One, you can tune down from zero beat to produce two slightly different beat tones. Two, you can zero beat the station, then move off slightly to produce an audio tone. In either case, users of DC receivers begin to find a fix that will work.

When the audio circuit includes a filter centered around the common 750 Hz frequency, tuning becomes real fun! I use the zero-beat-and-move method, which works best for me.

Since the VFO operates very close to the desired receive frequency, it did not take too long for some QRPer to connect the output from the VFO to a low power transmitter. Instant transceiver! Instant problem!

Direct Conversion Designs

These run the entire spectrum from really bad to outstanding. The HW-7 receiver, for example, is the pits. Both the HW-7 and the HW-8 use a DC receiver.

We've been listening for some time to a Delaware station on 40 meters with your hamfest special HW-8. Since you and I both know there are only three active hams in that state, you would like to work him. You tune him in till he's centered in the filter. A good solid 5NN. He signs his call and you send him yours. Nothing. You try again. Nothing. One more time. Nothing. What's wrong? You're on the wrong side of zero beat. He can't HEAR you.

The VFO is sitting on 7039 MHz. Delaware is calling on 7040. You tune for max audio from the filter, but you're on the low side of his signal. This happens too often to the new user of an HW-8. The HW-8 uses what is known as "receive high—transmit low" tuning scheme. When the HW-8 goes to transmit, the frequency is down-shifted about 750 Hertz. To make matters worse, most HW-8s don't shift the same. The HW-8 depends on the load from the transmitter to move the VFO. A HW-8 can off-shift as much as 3 kHz!

> ***"I don't care for a dash of AM with my CW."***

Yup, there is a mod to correct this problem, but you should be aware that it does happen. If you tune from the low side up, find that Delaware station calling CQ, and transmit, you'll be about 1500 kHz BELOW his frequency. He'll never hear you. So to work the station, you have to tune from the high end of the band DOWN to the station. When the HW-8 goes to transmit, 750 Hertz lower, he'll hear us.

Problems with Direct Conversion

Things really get messy when the other operator uses a highly filtered superhet receiver. Most operators don't use the RIT to move about, looking for stations calling them. Most SSB superhet transceivers offset the transmitter differently. This causes much trouble for the HW-8 user, if the transceiver is tuned improperly.

As if that were not enough, the gain of the DC receiver is produced within the audio chain, and all that gain is hard to control. Many DC receivers are microphonic. Slight movement of anything will be picked up and amplified by the audio circuits. While using DC receivers, I've heard ants walking on the table.

Direct conversion receivers are prone to pick up AM signals from anywhere. Heaven help you if you live near an AM broadcast station. I don't care for a dash of AM with my CW.

The lack of selectivity can really be a problem. Since we must use audio filtering for selectivity, the use of low noise transistors and ICs are a must. A high noise factor can mask even the strongest stations.

The use of AC operated power supplies can cause all kind of hum to be picked up by the audio circuits. This is called common-mode hum. Basically, energy from the VFO gets into the power supply. The power supply radiates the signal back out via the supply lines. The antenna picks up the signal and the whole thing repeats. When you're operating on battery power, you don't have to worry about common-mode hum.

Admirable Features

With all these problems, who in their right mind would operate, let alone build, one? Let's look at several good points of the DC receiver. They are extremely easy to build and get operating. Sensitivity is outstanding; a good DC receiver can surpass many a superhet in sensitivity. Signals seem to jump out of the speaker. Crisp clear audio makes for superlative listening pleasure. Since the VFO operates near the operating frequency, transceiver operation is easy. Because of the low part count, battery operation, and thus portable operation, is effortless. As you can see, the DC receiver does in fact have a lot going for it. Since we've looked things over this month, we'll start to build some simple receivers. Keep the soldering iron at hand.

Also, I'm still looking for mods for the HW-7, HW-8, and HW-9 for the third edition of the *Hot Water Handbook*. Send them to me and if I use them, you'll receive a free copy of the book.

Don't forget about the field day photos. Have yet to receive any. If you want bragging rights, here's your chance.

What's coming down the line? Lots of good stuff! Right now, I'm off for some portable QRP on the bike. 73

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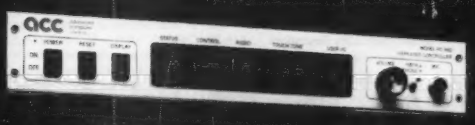

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At Last: No-Code Ticket Support from Newington!

The ARRL Board has said yes to a no-code ticket! The Leagues' Board of Directors met Friday and Saturday, July 21 and 22, in Windsor Locks, Connecticut. After extensive and sometimes heated discussion, they agreed by a close 9 to 6 vote on a proposal recommending a codeless class of amateur license, which they will present to the FCC as a petition.

Under the ARRL plan, this would not be an easy license to obtain. The testing would be more rigorous than that now required for a Technician class ticket. The examination, given through the VEC system, would consist of Element 2 and an expanded Element 3A, including questions related to Morse code.

To upgrade to Technician, the new licensee would only have to pass a VEC 5 wpm Morse code test. The proposal does not address the question of what will happen to the Novice license as we know it today.

Communicator Class License

Callsigns would be assigned from the Group D callsign block. This would make it impossible for currently licensed or higher grade amateurs to tell a code-free from a code-hazed amateur without consulting a call directory. The idea is to minimize any chance of license class bigotry and isolation of the no-codes. Frequency privileges would be 220 MHz and above, with output power limited to 250 watts. The no-code licensee would not be permitted to act as control operator of a repeater or auxiliary station, but he could legitimately own and operate a repeater or remote under the higher class license of another amateur.

The ARRL directors think the best name for the proposed ticket is the Communicator class, which should not be confused with an unpopular FCC proposal in 1974 to create a new class of license also called the Communicator.

The League's no-code license proposal is probably in the hands of the FCC by now. The FCC has the option of issuing a Notice of Inquiry or, if it deems appropriate, going directly to a Notice of Proposed Rule Making on the Creation of a Codefree Entry Level Amateur License.

If At First You Don't Succeed . . .

Unlike the 1983 attempt to create a code-free entry level license, this time the concept will probably become reality. While there is bound to be some opposition from the amateur community, at least a narrow majority of the ARRL leadership has gone on public record as favoring the idea. Well before an anti-no-code grass roots campaign could start, League President Larry Price W4RA placed his head on the political chopping block by creating the League's No-Code Advisory Committee. Price was astute enough to select George Wilson W4OYI to chair the committee, and to direct that it be composed of representatives from every facet of the amateur community, including the amateur support industry.

Last spring, the Committee released findings favorable to such a new license. Less than two months later, the ARRL Board went on record as being in favor of such a license.

The no-code concept also has the open support of powerful groups in the hobby. This includes AMSAT-North America, Tuscon Amateur Packet Radio Inc. (TAPR), the Amateur Industry Association, the National Amateur Radio Association, the International Amateur Radio Network, and most amateur publications. While several anti-no-code organizations have appeared on various packet BBSs—primarily in the northeastern part of the country—none of these appears to have wide support as yet.

When Will It Happen?

The real question appears to be not whether, but when, there will be a no-code license. If the FCC elects to go directly to Notice of Proposed Rule Making (NPRM) or, if the ARRL proposal is submitted as an NPRM, in theory no-code could become a reality by year's end. It's best, though, to not hold your breath. Between one and two years is more likely, and even longer if the matter starts as a Notice of Inquiry. If all goes as most experts suggest, look for an official no-code license announcement at the 1991 Dayton Hamvention, the traditional place and time for the ARRL to release major changes or findings.

As to the final rules governing a code-free license, the ARRL proposal is middle-of-the road. But it also places the Commission in a strange bind because the FCC has possibly a dozen or more other code-free license proposals to consider. These have come from just about every arena in the amateur community. Many are far more liberal in both testing requirements and privileges granted. In making any decision the FCC must give equal consideration to each of these proposals.

Who Voted How

It will be interesting to see just how much opposition there really is to no-code. At different times over the next two years, the entire ARRL Board of Directors stands for re-election. ARRL Directors voting in favor of no-code were Hugh Turnbull W3ABC, Atlantic Division; Howard Mark WØOZC, Dakota Division; Steve Mendelsohn WA2DHF, Hudson Division; Tom Frenaye K1KI, New England Division; Rush Drake W7RM, Northwestern Division; John Kanode N4MM, Roanoke Division; Marshall Quiat AGØX, Rocky Mountain Division; Frank Butler W4RH, Southeastern Division; and Jim Haynie WB5JBP, West Gulf Division. In opposition to no-code were Directors Ed Metzger W9PRN, Central Division; Joel Harrison WB5IGF, Delta Division; Leonard Nathanson W8RC, Great Lakes Division; Paul Grauer WØFIR, Midwest Division; Rod Stafford KB6ZV, Pacific Division; and Fried Heyn WA6WZO, Southwestern Division.

Are We All Ready?

If, as the anti-no-code "packet propagandists" claim, there is heavy sentiment in the ARRL rank and file that they were sold out on no-code by their leaders, we should see a major shift in ARRL leadership over the next two years. However, except for those individuals who may not run for office again, I'm willing to bet there will be little change in the ARRL directorate attributable to the no-code issue. The time for this license class has long been overdue. 73

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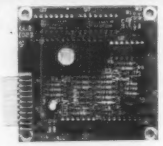

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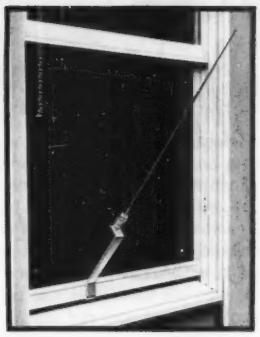

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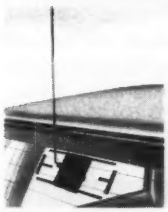

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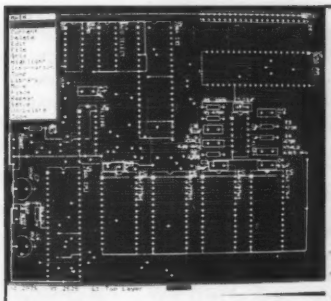

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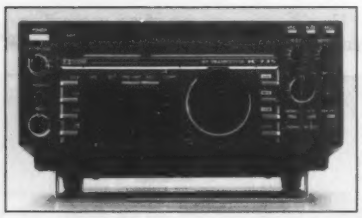
HF RIGS

ICOM IC-735



The IC-735 is a compact and full-featured HF transceiver with general receiver coverage. It measures 3.7″ (H) x 9.5″ (W) x 9.4″ (D), making it well-suited for mobile operation in cars, airplanes, and boats, as well as for base station operation. It covers all amateur HF frequencies from 1.8 to 30 MHz, and has continuous receive from 100 kHz to 30 MHz. The 735 covers SSB, CW, FM, and AM modes. The rear panel has ports for AFSK operation.

The IC-735 has three scanning functions: memory scan, programmed scan, and mode scan. In addition, it has two VFOs and tunes to 10 Hz resolution, suiting it ideally for most modes, even HF packet. For lovers of CW, the 735 supports both break-in (QSK) and semi-break-in operation. A DC cable comes with it for mobile operation.

The IC-735 retails for $1150. Contact *ICOM America, Inc., 2380 116th Ave. N.E., Bellevue WA 98009-9029, (206) 454–7619*, or circle Reader Service number 220.

KENWOOD TS-940S

The TS-940S is a full-featured HF transceiver that provides AM/FM/FSK/SSB/CW operation for all amateur bands from 160 to 10 meters. General receiver coverage ranges from 30 kHz to 30 MHz, with all-mode transmitter operation on all HF amateur bands. All switches and dials on the front panel are easily accessible.

The receiver has continuously variable IF bandwidth. In SSB mode, the lower and upper filter skirts are independently variable, providing versatile "low-cut" and "high-cut" operation. In CW and RTTY mode, there is a single knob to vary the width of the passband. In CW mode, you can also vary the BFO injection frequency, thus allowing you to pick a desired CW tone while keeping the signal in the center of the IF passband. Optional CW filters include those for 250 Hz and 500 Hz. The 940S has a multi-function liquid crystal display that displays memory frequency content, time, and IF bandwidth.

The TS-940S retails for $2500 ($2270 without optional automatic antenna tuner). Contact *Kenwood USA Corp., PO Box 22745, Long Beach CA 90801-5745, (213) 639–4200*.

MOBILE RIGS

YAESU FT-790RII

The FT-790RII is an SSB/CW/FM 70cm transceiver for 430–450 MHz operation. It uses the same accessories as the 690R and 290R, is the same size, and shares much the same control setup.

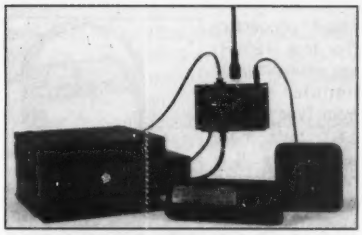
The FT-790RII has 10 memory channels, and offers three scanning options: VFO scanning, memory scan, and programmable scan. It also has priority channel operation, and duplex operation for non-standard offsets. This transceiver covers the 70cm band in two segments: 430–440 MHz, and 440–450 MHz. Three tuning rates are available for each mode (SSB/CW—25 Hz, 100 Hz, and 2.5 kHz, FM—12.5 kHz, 25 kHz, and 50 kHz).

If you like to operate 70cm portable anywhere—camping, at the beach, on a boat—this transceiver belongs on your wish list. Its small size lends itself to any number of operating situations, and it packs a lot of punch for its size.

The FT-790RII retails for $681. Contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701, (213) 404–2700*, or circle Reader Service number 222.

ICOM IC-901

The IC-901 multiband HF/VHF/UHF/microwave mobile transceiver improves on its predecessor, the IC-900. It comes standard as a dual-band FM transceiver (2 meter and 440 MHz), but you can add up to to four more band units for 10m, 6m, 220 MHz, and 1.2 GHz. There is also a band unit available for 2m SSB and CW.

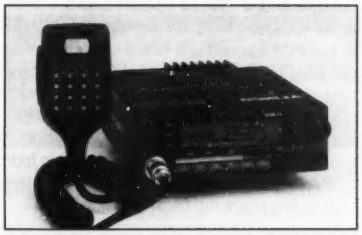


Like the IC-900, the IC-901 is comprised of band units, an interface box, and a control head. Using fiber optic cables, you can remote the band units and interface box (e.g. to the trunk) and mount the control head within easy reach. This keeps the majority of your station out of sight, reducing the chance of theft. You can also install the control head directly to the interface box for a compact transceiver.

Other standard features include an extra-large multi-color LCD that visually displays squelch and volume settings, touch-tone microphone, and sub-audible tone encode/decode for private channel operation.

The retail price for the base system is $1,200. Contact *ICOM America, Inc., 2380 116th Ave. N.E., Bellevue WA 98009-9029, (206) 454–7619*, or circle Reader Service number 223.

ALINCO DR-570T



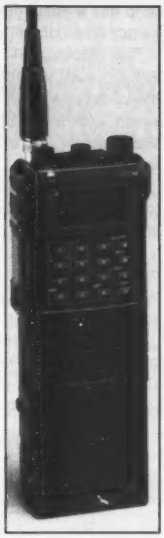
The DR-570T 2m/70cm dual-band mobile transceiver is the successor to Alinco's 24T. It has independent main band and subband operation, which allows full duplex operation, low power, four scanning (memory, programmed, busy channel, and free channel) functions, full reverse operation, priority, call, and ABX functions.

The 37 selectable sub-audible tone frequencies can be called for encode or encode/decode (tone squelch CTCSS), permitting private access. The front panel is easy to read and the large controls are very accessible. The dual function push switches have unique raised patterns on their surfaces to allow the mobile operator to easily tell them apart just by feel. The multi-color LCD display lets the operator know which functions are in operation. The built-in duplexer has a single antenna output for a dual-band antenna. There are plenty of beep and bell tones that give a range of information during tuning—again to allow the mobile op to keep the eyes on the road—but the user can shut them off if desired.

The retail price is in the $500–$600 range. Contact *Alinco Electronics Inc., 20705 South Western Ave., Suite 104, Torrance CA 90501, (213) 618–8616*, or circle Reader Service number 224.

HANDHELDS

ICOM IC-32AT



The IC-32AT 2m/70cm dual-band HT offers five watts of power output on each band, receives 138–174 MHz, and transmits 140–150 MHz and 440–450 MHz. It features full duplex capability, 40 memory channels, programmable scan, memory scan, and an optional UT-40 tone squelch unit.

This HT also offers DTMF keyboard access with direct frequency entry from the keyboard, a repeater input monitor, priority watch, and a dial select function. Plus, it's splash resistant—rubber gaskets protect the transceiver from dust and moisture.

The retail price for the IC-32AT is $630. Contact *ICOM America, Inc., 2380 116th Ave. N.E., Bellevue WA 98009-9029, (206) 454–7619*, or circle Reader Service number 225.

KENWOOD TH-25AT

The TH-25AT is a full-featured programmable 2m HT. It's small, rugged, and the case is water resistant.

The LCD, mounted on top, has a bar graph S-meter which also functions as a battery voltage indicator during transmit. It has a lock switch to prevent accidental frequency changes. The LEDs are surprisingly bright, making the display easy to read in the dark.

A 600mAh NiCd battery comes with the TH-25AT. There is an automatic battery-saver circuit, and an optional AA battery case. Plus, there's an automatic power-off circuit which shuts off the rig after 59 minutes of inactivity.

The unit receives from 141–163 MHz. It has fourteen memories, band scan functions, and memory lockout.

The TH-25AT retails for $330. Contact *Kenwood USA Corp., PO Box 22745, Long Beach CA 90801-5745, (213) 639–4200*.

YAESU FT-411

The FT-411 micro-sized HT provides up to five watts output across the 2 meter band. It has 49 memories and VFOs controlled by a 16-button backlit keypad.

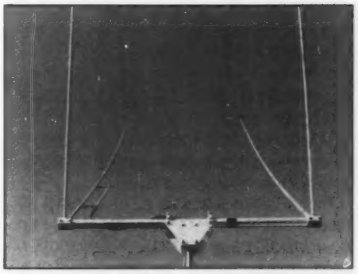
All memories store repeater offsets or separate TX/RX frequencies, and CTCSS tones when the optional FTS-17 Tone Squelch Unit is installed. A unique feature of the 411 is its ability to store DTMF tone series in macros, allowing you to dial a number on an autopatch with a single keystroke! The keypad serves as a DTMF encoder during transmission. 10 DTMF memories can be used to store 15 digits each.

Other FT-411 features include: busy channel lockout; subband (programmable), and selective memory scanning; priority channel monitoring; 1 MHz up/down stepping; automatic repeater shift (±600 kHz) in the repeater subbands; and a top panel rotary dial for memory and frequency selection.

The FT-411 retails for $406. Contact *Yaesu USA, 17210 Edwards Road, Cerritos CA 90701, (213) 404–2700*, or circle Reader Service number 226.

ANTENNAS/TUNERS

DELTA LOOP DL-102



The DL-102 is a V-shaped 10m beam with the element tips connected together with copper wire. A 5-foot boom supports the "arms" (elements). The elements are attached to the boom by heliarc welded element "horn" clamps. A mast mounting bracket attaches the boom to the supporting mast.

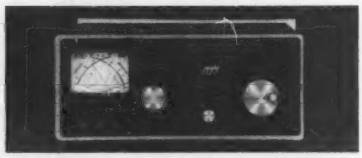
This antenna exhibits the same general broadband characteristics and electrical properties as full-wave loop antennas such as the quad. Some of the other interesting specifications are weight: 21 lbs., element arm length: 12 ft., boom length: 5 ft., turning radius: 7 ft., surface area: 2.9 sq. ft., and element spacing: ⅛ wavelength. The Delta Loop also has an adjustable gamma match (rated to 2kW), with an input impedance of 500Ω. The gamma match is factory pretuned and wired. All you need to do is connect your coax to the bracket.

This antenna is built to last. All of the tubing is 6061-T6 aluminum. There are no castings, and all the hardware is mil-spec stainless steel.

Another nice feature of the DL-102 is that it has a surface area of only 2.9 square feet. That, plus its relatively light weight, allows you to use a rotator with the Delta Loop as light duty as a good TV antenna rotator.

Suggested retail price for the DL-102: $300. Delta loops for 15m and 20m are also available. Contact *Delta Loop Antennas, 12 Brush Dr., PO Box 8063, New Fairfield CT 06812, (203) 746-6368*, or circle Reader Service number 219.

MFJ DIFFERENTIAL T TUNER



MFJ's innovative MFJ-986 Differential-T™ 3kW roller inductor tuner gives you three innovations in antenna tuner technology.

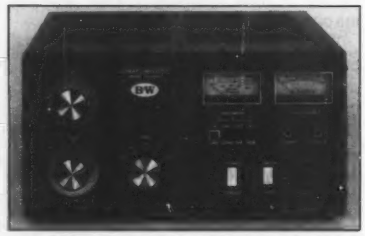
First, you get a differential capacitor that simplifies tuning and gives you minimum SWR at only one setting. Second, MFJ's new peak and average reading SWR/Wattmeter has a new directional coupler that gives you more accurate SWR and power readings over a wider frequency range. Third, a new current balun reduces feedline radiation and field pattern distortion.

This 10¾" x 4½" x 15" unit also gives you a 6-position ceramic antenna switch that lets you select two coax lines (direct or through the tuner), random wire, balanced line, and external dummy load. A three-digit turns counter lets you quickly reset the tuner to operate on your favorite frequency. You also get MFJ's full one-year No Matter What™ Guarantee: MFJ will repair or replace (at their option) your MFJ multi-mode, no matter what happens to it, within that first year.

The MFJ-986 retails for $270. Contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762, (601) 323-5869 or (800) 647-1800*, or circle Reader Service number 218.

LINEAR AMPS

BARKER & WILLIAMSON PT-2500A HF AMP



The PT-2500A 1.5 kW amplifier is a superb Class AB2 linear amplifier, rated for continuous duty at 1500 watts output. The PT-2500A offers excellent performance for any mode or style of operation, even HF packet.

The PT-2500A uses two Eimac 3-500Z zero-bias triodes, tried and true workhorses in many HF amp designs. There is very little intermodulation distortion (– 33 dB), and the amp has a minimum of 60 percent plate efficiency on all HF bands.

The output circuit is a pi-L design using a 235 pF, 6 kV variable tuning capacitor and a heavy-duty, silver-plated 7 kV rotary inductor, which allows impedance matching over an even greater range than the simpler pi- and L-networks.

Since the PT-2500A uses a grounded-grid (cathode-driven) design, it is well suited for HF linear operations.

The power supply is worthy of a continuous-duty amplifier. Although B & W recommends 230 VAC primary power, the unit will run from 115 VAC if 25–30 ampere service is available.

The suggested retail price is $2175. Contact *Barker & Williamson, 10 Canal Street, Bristol, CT 19007, (215) 788–5581*, or circle Reader Service number 229.

AMERITRON AL-80A

The Ameritron AL-80A delivers over 1000 watts PEP, 850 watts CW, and 500 watts RTTY, with only 85 watts drive. It uses the industry standard 3-500Z tube with a heavy duty tank circuit to achieve up to 70% plate efficiency from 160 through 15 meters The unit is also easily modified to use on 10m. A Pi-L circuit gives smooth tuning and full band coverage, even on 80 and 160 meters. The 80A also features smooth-operating vernier controls.

There are two lighted meters. One gives a continuous reading of the 3-500Z grid current. The other meter is a multimeter that displays plate voltage, plate current, peak RF output, and drive power/ALC detector voltage.

The AL-80A measures 15"(D) x 14¾"(W) x 10"(H). It comes with a two-year warranty. The unit retails for $995. Contact *Ameritron, Inc., 2375 Dorr Street, Toledo OH 43607, (601) 323–9715*, or circle Reader Service number 230.

TEST EQUIPMENT

COAXIAL DYNAMICS 81000A RF WATTMETER

Get Bird quality without paying Bird prices! Coaxial Dynamics' Model 81000A is a handy, portable, and economic wattmeter for measuring RF power. It includes a large, clear, easy-to-read meter scale with a mirrored backing, to eliminate parallax error.

You can choose from a full line of economically priced detecting elements to cover 100 milliwatts to 10,000 watts. The Model 81000A's frequency range covers 0.45 MHz to 2300 MHz. Standard elements are available from 2 to 1300 MHz, others on request. "Quick Match" connectors (for low VSWR) are available in all popular series from Type SMA to 1⅝", both male and female. It is normally supplied with type "N" female. The SO-239 connector is also available.

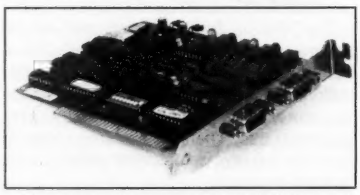
The Model 81000A is available at most amateur radio supply stores. The suggested retail price is $160, with extra elements priced from $50 to $100. For more information contact *Coaxial Dynamics, Inc., 15210 Industrial Parkway, Cleveland OH 44135, (216) 267–2233 or (800) COAXIAL*, or circle Reader Service number 227.

PACKET/DIGITAL

DRSI PC*PACKET ADAPTOR CARD

The DRSI PC* Packet Adaptor (PCPA) is a board that plugs into your IBM (or compatible) and turns it into a complete packet radio communications system. With the PCPA, you no longer need a TNC—the PC* Packet Adaptor has all the functions of a TNC, and more. The software that comes with the board lets you operate it as a TNC, a bulletin board, a Net/ROM node, and a TCP/IP network host.

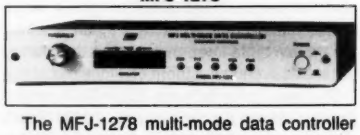
The PCPA board is a half-length card. You can plug it into any slot in any PC/XT/AT-compatible computer system. The board is available in three versions: 1200 bps modem/RS-232 port, no modem/two RS-232 ports, and two 1200 bps modems. You can run up to four PCPA boards in the same PC, and all the boards can share the same IRQ line.



One of the strengths of the PCPA is that it comes with so much software: the basic PC/TNC package; the "BB" bulletin board package by AA4RE; PC/Node; NET/ROM; the BBS package by G8BPQ; and the KA9Q TCP/IP "Net" package.

The DRSI PC* Packet Adaptor retails for $140–$170 (there are three models available). Contact *DRSI, 2065 Range Road, Clearwater FL 34625, (800) 999–0204*, or circle Reader Service number 213.

MFJ-1278



The MFJ-1278 multi-mode data controller supports nine digital modes: packet, AMTOR, RTTY, ASCII, CW, WEFAX, SSTV, Navtex, and full-featured Contest Memory Keyer. It

also offers the new Easy Mail™ Personal Mailbox, the new Multi-Gray Level FAX/SSTV Modem, 20 LED tuning indicator, 32K of RAM, FAX transmitting, and true DCD.

Other features include AC power supply (or use 12 VDC), KISS code, random code generator, independent printer port, lithium battery backup, RS-232 and TTL serial ports, standard 850 Hz RTTY shift, socketed ICs, programmable message memories, software-selectable dual radio ports, and much more—all in a sleek 9½" x 9½" x 1½" cabinet.

Hooking up your MFJ-1278 is easy. All you need is the MFJ-1278, your rig, any computer, the appropriate radio/1278 and 1278/computer cables, and a terminal program. MFJ offers software starter packs, at $24.95 each, for IBM compatible, Commodore 64/128/VIC-20, or Macintosh computers. They include interface cable and software on disk or tape.

You also get MFJ's full one-year No Matter What™ Guarantee. (See page 62, the MFJ-986.)

The MFJ-1278 retails for $280. Contact MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762, (601) 323–5869 or (800) 647–1800, *or circle Reader Service number 214.*

KANTRONICS KAM DATA CONTROLLER

The Kantronics KAM is a multi-mode data interface that encodes/decodes CW, packet, RTTY, ASCII, and AMTOR. It can be used with a personal computer to receive weather facsimile (WEFAX) broadcasts.

The KAM is a modem-sized box, 22.5 x 14.7 x 4.7 cm. The front panel has two push-button controls, one for power and one to select the FM or AM (limiter-less) operation of the HF modem. The rest of the front-panel controls are LED status indicators, plus an easy-to-read green bar graph tuning indicator. The back panel has two radio connectors, a connector for the computer/terminal, and a connector for power.

The KAM comes equipped with two special packet features not found in most other TNCs or multi-modes: a gateway function and a personal mailbox. The gateway function permits the KAM to act as a crossband digipeater when both the HF and VHF ports are enabled. The personal packet mailbox (PPM) lets users or BBS stations connect to the KAM and leave or retrieve messages. In essence, the KAM becomes a small BBS with messages stored in the KAM's memory, rather than on a disk.

If you are looking for a small, low-power, lightweight, all-purpose terminal unit to use with your personal computer, the KAM may be the answer. It retails for $320. Contact *Kantronics, Inc., 1202 E. 23rd Street, Lawrence KS 66046, (913) 842–7745*, or circle Reader Service number 215.

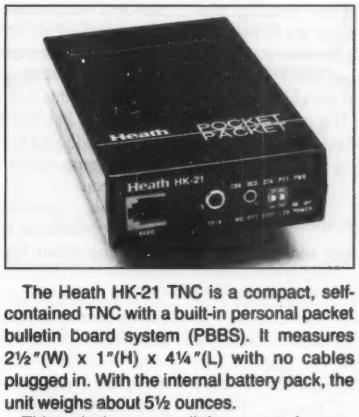
UNIVERSAL M-7000 MULTI-MODE DECODER

The Universal M-7000 is a sophisticated multi-mode code converter. This dedicated device (no computer required) decodes Morse code, Baudot RTTY, Bit-Inverted Baudot, SITOR A and B, ASCII, and packet. It can also display facsimile in all speeds and IOCs.

Other, more exotic, modes, such as FDM (VFT) 8, 12, 16, and 24 channel, can also be intercepted. Synchronous military modes such as ARQ-M2, ARQ-E, and ARQ-E3 are uniquely available through the M-7000. Other advanced capabilities include Russian Third Shift Cyrillic, Literal Mode, and Databit Mode. Auto baud, auto shift, and auto tuning are supported. Convenience features include diversity inputs, ATC, MSI, UOS, OPI, SelCals, and Autostart. The M-7000 will output to a monitor, printer, or terminal control.

Retail prices are in the $1000 range. Contact *Universal Radio, 1280 Aida Drive, Reynoldsburg OH 43068, (614) 866–4267, or (800) 431–3939*, or circle Reader Service number 216.

HEATHKIT HK-21 TNC



The Heath HK-21 TNC is a compact, self-contained TNC with a built-in personal packet bulletin board system (PBBS). It measures 2½"(W) x 1"(H) x 4¼"(L) with no cables plugged in. With the internal battery pack, the unit weighs about 5½ ounces.

This unit draws very little current. In standard 12 volt DC use, it draws a little less than 40 mA. The optional NiCd battery pack is rated at 120 mAh, and is charged whenever external battery power is applied.

The HK-21's PBBS is quite complete. An outside computer isn't necessary; software and message storage is part of the HK-21.

The HK-21 retails for $220 (plus $18 for the battery pack). Contact *Heathkit, Benton Harbor MI 49022, (800) 253–0570*, or circle Reader Service number 217.

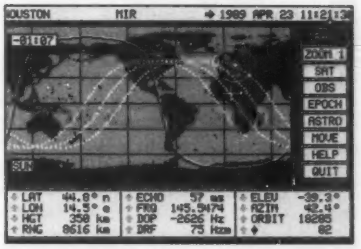
SOFTWARE

INSTANT TRACK

Instant Track is a high-end satellite tracker IBM PClone program that carries a very low-end price. It is full-featured and a joy to use.

The main menu lets you edit your station elements, any of up to 200 satellites in its library, and gives you a choice of functions. The startup screen even gives favorite satellite statuses, so you instantly see if they're up or down.

You can graphically display an excellent Mercator projection of the world, on an EGA/VGA screen, with locations of sun, moon, day/night terminal line, and your bird of choice continuously updated. You can also invoke a



text screen that includes live data for multiple stations, and print a quick-reference operating schedule. After putting in the latitude and longitude, the program gives you your grid square and distance from the nearest city.

Two other program innovations are: squint angle window (in addition to the standard footprint), and running the tracking functions in a background program to aim your antennas while you continue with other tasks on the same computer!

Instant Track perfoms best on an AT-class machine with coprocessor and EGA or VGA display, but will work either without the math chip or on a vanilla XT.

At this writing, Instant Track will most likely be available as share-ware with a requested donation of $50 to AMSAT (address on the program). Contact *Project OSCAR, PO Box 1136, Los Altos CA 94023-1136.* for more information.

GGTE MORSE TUTOR

Morse Tutor runs on any MS-DOS computer, with as little as 128K of memory, and easily matches the clock of most users' machines.

The Morse Tutor program offers the user a choice of two methods of Morse code instruction—Standard or Farnsworth. The Farnsworth method allows independent character and word speed settings—Morse learners can set the character speed at the goal speed, which means they don't need to relearn a new sound for the same character as their copy rate picks up.

This program takes you from an introduction of all the letters in the alphabet, the numbers 1–9, 0, punctuation, and pro-words (telegraphy-specific codes), to sending you a QSO built by the program itself!

Morse Tutor replaces your Elmer in two critical areas: It chooses one of billions of possible random QSO combinations to send, making them impossible to predict, and it lets you immediately check copy accuracy.

Morse Tutor retails for $20. Contact *Uncle Wayne's Bookshop,* 73 Magazine, *Forest Rd., Hancock, NH 03449.*

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego, California 92119

PC Board Techniques

This month we'll cover questions about PC board production and methods. While there are several methods that give good results, only two basic methods are outstanding. Proper selection of board materials and the type of traces on the board are all important, especially at UHF and above.

The most common methods use photo sensitive boards, silk screen inks, copied Mylar™ transfers, and direct transfers or rub-on's. In choosing one method over another, consider the cost of supplies versus the quantity of boards you wish to make. If you only want to make one or two PC boards, I recommend going with the photo (sensitized) resist method.

Photo Sensitized Boards

This method has several pitfalls, but you can avoid them with careful preparation. The watchword is cleanliness. You can buy the PC board pre-sensitized, or you can sensitize it with spray-on chemicals. Ready-to-go stock is a little pricey, but gives very good results. The problems with this method are improper exposure, poor cleaning of board stock (home sensitizing), and chemicals that have become weak from having been stored too long.

With photo resist, problem boards don't show until after you pull them from the etchant. If traces are mistakenly etched away, you have to junk the board and start again.

John WB6BKR uses the home-spray sensitized PC board technique, and it works very well for him. John made double-sided PC boards by first using a clear notebook cover for the front and rear backing of the PC board artwork. The artwork is placed on the inside of this V-shaped piece of clear plastic film to allow the artwork to come in direct contact with the PC board. This makes a good light seal for exposure, and also allows proper registration when making double-sided PC boards. The inside of the front is the top surface of your double-sided board, and the inside of the rear film is the bottom.

To home-sensitize, spray the photo resist on the cleaned PC board. Apply two or three thin coats, letting the photo resist dry between coats. The finished artwork in its V-shaped envelope allows the PC board to be inserted for exposure to strong ultraviolet or sunlight on each side. The frame to hold this can be a small piece of glass with a solid back to prevent light reaching the other side until you turn the board. Also, the frame holds the artwork in tight contact with the board, preventing light from undercutting the negative.

Simple PC Board Methods

On very simple or prototype PC boards, the cut-and-peel or masking tape works fine. You can cut some films with an X-acto™ knife and transfer the completed pattern to a silk screen for volume production. In the masking tape method the traces are transferred to the tape (paper side) via a piece of carbon paper, and the portions to be removed are cut out with an X-acto knife. The remaining tape serves as the "resist" to the etchant. This is good for only one board.

Silk Screen Method

I favor the silk screen method, which I've been using for the past 10 years or so, mainly because of material costs. The boards I've made were for club or multiple board projects. For quantity production, a $10 quart of ink does about 2000 PC boards. The silk screen material, about $20 per square yard, is polyester (305 threads per inch). The sensitizing film or transfer film can be either cut with a knife or transferred from photo negatives. The film is made by Ulano, 210 E. 86th St., New York, New York 10028, telephone (212) 628–7960. I use the RX-200 and RX-300 photo transfer films. Capillex-25, a newer film, costs about $10 for a piece 24″ X 40″. (You can handle this film in normal light.) This sheet of film can make patterns for several years.

The inks used in making PC boards are all petroleum based. I use Naz Dar Circuit Black 211, which is excellent in combination with ferric chloride as a etch. You can order it from Naz Dar, Garden Grove, California, telephone (714) 894–7958. I apply the ink with a squeegee, forcing it through the open patterns in the screen onto the copper PC board foil. Note that the artwork transfer films and blockout are all water-based. This distinction makes the screen printing easily reusable. If you wish to keep the screen, clean up the printing inks with paint thinner, and store when dry. If you wish to remove the transfer film, wash it with lukewarm water and it's ready for a new pattern. This makes screen printing very inexpensive.

Boards for Up-Frequency

In making a PC board for VHF/UHF, always use double-sided board. Etch your traces on the bottom of the board, and retain the top copper surface to serve as a common ground. This gives all ground connections a low impedance connection to VHF/UHF circuits. It's common to solder a short piece of copper or brass ribbon, folding the edge to give you a full ground surface around the outside of the board. Solder to both top and bottom. PC board traces at UHF do not like abrupt corners, so trim off the sharp edges to about 45 degrees. The exception to this rule is in stripline techniques. In stripline, the entire trace is made for a set impedance, and trimming would change this impedance.

Drill all connection holes for those connections not requiring grounding. Ream the holes in the the top of the board with a 3/16″ to ¼″ drill bit to give clearance to the component leads when mounted on top of the board's ground surface. Instead of a drill bit, you might want to use a more professional tool. Vector, 12460 Gladstone Ave., Sylmar, California 91342, makes a $15 pad cutter, Part #138APD, for just this purpose. It centers on the drilled hole (0.040″).

Now drill the holes for connections requiring grounding. Do not ream ground holes. These ground holes are soldered on top as well as on the bottom of the board, giving you a shield and low inductance ground connections. This is very important at VHF/UHF. All other connections are soldered only on the trace or bottom side of the board. The alternative would be to use plated through-holes, but that's beyond simple garage operation.

Combine a good photo transfer from negatives from magazine articles or original artwork, and photo to the negative to the transfer film. Adhere it to the silk screen, and you're ready to make boards any time you desire. By making your own frames, you can save even more. The frames resemble a picture frame with a deep-cut center on one side. This groove holds the screen material taut with roping similar to that in aluminum screen doors.

PC Board Material

The next most important part of board construction is the board itself. Most high quality PC board material is a fiberglass-epoxy type called G-10. Avoid bargain boards made of paper or similar dielectric types. They tend to pick up processing chemicals and hold moisture. At VHF and higher the abnormalities can cause problems.

G-10 fiberglass-epoxy PC board material is consistent and available in surplus quantities. Check nearby PC board houses, as they might sell scraps. When cut, the edges of this type of board are sharp, due to the fiberglas cloth used to make the dielectric material. Normally this type of board material has a dielectric constant of 5, which you can verify by measuring the capacitance of the sample double-sided board and calculating the constant.

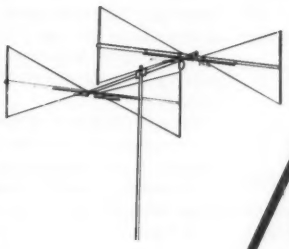
Normally G-10 epoxy PC board material is not used on frequencies above 1300 MHz due to RF loss. Low-loss Teflon™ fiberglass, with a dielectric constant (Esr) from 2.2 to about 2.5, is commonly used. How important is the dielectric constant (Esr)? A higher Esr allows smaller circuitry at VHF and microwave frequencies. The Esr's of some low-loss aluminum and ceramic PC board materials go as high as 10 to 20, making for very small circuitry. Using G-10, I limit my construction to 1.3 GHz, and using Teflon, up to 24 GHz.

Duroid™ is a very fine form of Teflon with excellent dielectric stability due to the board components being cut up to a very fine consistency. This gives a high probability of repeatable circuits in large volume production. Normal woven Teflon may have irregularities, though I haven't had any trouble at 10 GHz with it.

Starter and PC Board Kits

Checking the catalog from Newark Electronics, I found several starter kits for printed circuit board construction, listed below.

The HF5B "Butterfly"™
A Compact 2 Element Beam
for 20-15-12-10 Meters
Operate As A Di-Pole on 17 Meters



- Unique design reduces size but **not** performance.
- No lossy traps; full element radiates on all bands.
- Turns with TV rotor
- 19 lbs.

HF ANTENNAS FROM BUTTERNUT

Butternut Verticals

Butternut's HF verticals use highest-Q tuning circuits (not lossy traps!) to outperform all multiband designs of comparable size!

Model HF6V

- 80, 40, 30, 20 15 and 10 meters automatic bandswitching.
- Add-on kit for 17 and 12 meters available now.
- 26 ft. tall

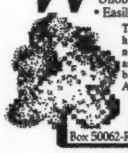
Model HF2V

- Designed for the low-band DXer
- Automatic bandswitching on 80 and 40 meters
- Add-on units for 160 and 30 or 20 meters
- 32 feet tall - may be top loaded for additional bandwidth.

For more information see your dealer or write for a free brochure

BUTTERNUT ELECTRONICS CO.
405 East Market, Lockhart, TX 78644

Where's the Beam?
Unobtrusive DX Gain Antennas for 80 thru 10
• Easily hidden • Install Fast • Fixed or Portable •



There's a 20 meter antenna with real DX Punch hidden in this picture. You can't see it, and your neighbors can't either. But it works DX barefoot anyway. How about a low profile 80/40/30 mi-bander? Or a 2 element monobander for the attic? All easily fit the pocketbook--Priced $29 to $99.

Work DX without telling the neighbors

Infopack $1 — *AntennasWest* — (801) 373-8425
Box 50062-R, Provo, UT 84605

CIRCLE 5 ON READER SERVICE CARD

1989 CALL DIRECTORY
(On microfiche)

Call Directory	$8
Name Index	8
Geographic Index	8
All three —	$20
Shipping per order	$3

BUCKMASTER PUBLISHING
Mineral, Virginia 23117
703: 894-5777 800: 282-5628

CIRCLE 7 ON READER SERVICE CARD

SUPER PERFORMANCE BATTERIES

UPDATED SUPER ICOM

SUPER ICOM BP-7S. 13.2 volts, 1200ma triple the capacity of the Icom BP-7, 5w output.
SUPER ICOM BP-8S. 9.6 volts, 1200ma, 50% more capacity than the Icom BP-8.
Both are rapid base charge only, or slide in wall charger, 4 inches high. BP-7S or BP-8S. $65.00

SUPER KENWOOD

SUPER KENWOOD PB-25S/PB-26S. 8.4 volts, 900ma, double the capacity of the PB-25/PB-26 for the 2500/2600/3500/3600. Charge with either the standard wall charger or drop in charger. 3 inches high. $65.00.

Exact replacement FNB-2 Nicad pack for Yaesu FT-404R/207R/208R/708R $22.50

SPEAKER/MICS

Icom HM-9	$35.00
Yaesu MH12A2B	$31.00

SUPER YAESU

SUPER YAESU FNB-4SH. 12 volts, 1000ma, double the capacity of the Yaesu FNB-4, 5 watt output. Rapid charge only. $71.00
SUPER YAESU FNB-3S. 9.6 volts, 1200ma, triple the capacity of the Yaesu FNB-3, 3.5 watt output. Rapid or wall charge. $65.00
Both are perfect for the 03, 09 and 727 series radios and are 4 inches high.

Inserts for:

Kenwood PB-25, 25H, 26	$25.00
Icom BP-3	$18.95
Icom BP-5 (500ma)	$24.95
Icom BP-7 (500ma)	$29.50
Icom BP-8	$29.50

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"I favor the silk screen method (for etching PC boards)."

Ferric chloride is the most common etch, so whatever method you use, the etch is the same. Many parts houses stock etch in quart containers, but you can obtain it cheaply from some chemical supply houses in larger quantities. The least expensive quantity is a "Carboy," which is about 14 gallons weighing 175 pounds. It costs about $80 with a $15 to $20 dollar deposit on the container.

Another source for your needs is Midland Technologies, 34375 E. Frontage Rd., Bozeman, Montana 59715.

Mail Bag Comments

Steve Noll WA6EJO writes that the Ventura 10 GHz beacon is active from Red Mountain, elevation 2080 feet. Power is 140 mW from a Gunn diode, and the frequency is 10.256 GHz, the 70th harmonic of 146.52 MHz. The antenna is a 17 dB horn vertically polarized with MCW ID. The Ventura club is actively taking off on a club project to construct 10 GHz transceivers.

John WA4WDL liked the homebuilt dish antenna by N6XQ in the April issue of *73*. He comments that Jack N6XQ is correct as long as each added parabola is perpendicular to and centered on one passing through the origin. In Jack's antenna, each rib is perpendicular to and centered on an imaginary rib passing vertically through the center of the antenna. His symmetrical design and two sideboards accomplish this. It is nice to see even a simple proof or demonstration worked out.

Bob NØDQD in Parker, Colorado, picked up several of the 10 mW 10 GHz transceivers at Dayton and is experimenting with them. He has modulated one with a carbon button mike in parallel with a 10Ω resistor in the DC feed to the Gunn device for AM modulation on a Gunn transmitter. This is more proof that just a few dollars and some experimentation can launch you into microwave operation!

Clint KA7OEI/3 is building a 23cm transceiver. He was trying to obtain a good mixer until he saw my construction article in the October '87 issue of *73* on a homebuilt 23cm mixer. He's going to include the mixer in his project. Clint is also collecting parts for 10 GHz operation.

I am putting together a list of beacons, and it will soon be available. Let me know if you have any beacon news so I can include it. This list is for any beacon operating from 50 MHz on up.

As always, I welcome your comments and want to hear from you about VHF/UHF/microwave projects and related items. Let me know what you would like to see in this column. Please send an SASE for a prompt reply.

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LETTERS

From the Hamshack

A True Reader

Just a little letter to inform you that your magazine is great! I'm currently obtaining my Novice, and I find your magazine very helpful in learning and understanding amateur radio. I'm not a subscriber, but I can assure you that I purchase your magazine every month via a friend's bookstore. She holds it for me, as my job requires traveling and magazines don't fair too well in my mailbox. Keep up the good work.

Mike Persechino
Columbus MS

Good Bait, No Bite

I just finished reading your June 1989 editorial about getting children interested in amateur radio. Though I have been impressed by most of your editorials, this one misses the mark; specifically because it tends to blame parents, television, the ARRL and the educational system.

We have two children (now adults) who we tried strenuously to interest in ham radio. We did everything you recommended and more. We even made the faculties of our electronics engineering firm available to our children and friends. We encouraged apprenticeship in our business, provided cash, equipment, and most of all, our time. We even offered bonuses for getting a ham ticket and upgrading.

What was the result? My son ran off to California. The parents of an apprentice threatened to sue me for allegedly using an idea which I had seen published years before. Another apprentice quit and tried to switch our customers to another company. And so on.

You're right about training the dog; but he hasn't learned to copy 5 wpm yet! As for the children and their generation, my wife and I don't know that anything more we could have done would've made a difference. What we do know, however, is that when we put away our checkbook—that made a difference!

Anonymous

Boycott Hams in South Africa?

I read a copy of the May issue of *73* and had to check the date. 1989 or was it 1959? It was 1989. I was appalled at the "Problem? What problem?" style with which the items in QRX and 73 International concerning South Africa were written.

Don't you people check the news once in a while? South Africa is one of the worst countries in the world for racism and civil rights violations. I know the ARRL goody-goody/no politics 1950s mentality says that this is no place for such issues, but the fact is that no sane, informed person can justify the policies of South Africa.

So if you do send a report to Radio RSA, tell them that their government sucks. Edit that, and you're gutless. Wanna be like *QST*? If you travel to South Africa, get on 2 meters, strike up a conversation, and after things get friendly, tell them that you're black. See what happens. Tell them that their government sucks. (Of course, that person could be black, but I'm sure that the frequencies are clearly marked there.)

Brian Longwell WB2DSH
Lawrence MA

When the government of a country does not live up to our ideals, should we stereotype all *the individuals in that geographic area and sever the lines of communication? Or should we keep in touch so that we can share our viewpoint and support people in South Africa who are working for equality?*

Person-to-person communication is what ham radio is all about. Prejudging an individual *on the basis of his QTH seems a bit extreme. Besides, racial prejudice isn't restricted to South Africa. . . Linda KA1UKM*

EM Zapping

When I opened the September issue of *73*, I was delighted. Paul Brodeur is an occasional contributor to *The New Yorker*, which I've read for more than forty years. I read his three articles with more than passing interest, having been a ham for more than thirty years. But when I mentioned them on our weekly session of QCWA, they were passed off as "some kooky article." I offered to copy the articles for anyone interested, and drew a blank.

In August, at the L.A. HamCon, my wife, K6YCP, and I attended the two-hour session devoted to the subject of electromagnetic radiation and amateur radio. The speakers were: Dr. Sam Milham, epidemiologist for the State of Washington; Dr. Robert Davis, also an epidemiologist in Washington; Dr. W. Ross Adey K6UI, Associate Chief of Staff for Research at the Loma Linda Veterans' Hospital; Dr. David Rodman KN2M, an ophthalmologist in Buffalo, New York; and Dr. Ivan Shulman WC2S, a cancer surgeon in Los Angeles.

The presentations were first class, with excellent slide illustrations. At the end there were questions and handouts:

1) From *Lancet* issue of 6 April 1985: "Silent Keys: Leukemia Mortality in Amateur Radio Operators," by Samuel Milham, Jr.;

2) American Journal of Epidemiology, vol. 127, no. 1: "Increased Mortality in Amateur Radio Operators Due to Lymphatic and Hematopoietic Malignancies," also by Milham;

3) *American Journal of Epidemiology*, vol. 128, no. 5, November 1988: "Mortality by License Class in Amateur Radio Operators," by Milham.

The Southern California 6 Meter Club taped the session, and offered to dupe it for clubs wishing to send a blank VHS cassette.

I mentioned the subject once again on the QCWA net, and several old geezers replied with "Hogwash!" This leaves me feeling frustrated, as you probably can imagine, when the evidence is readily available.

I think Brodeur's articles, "The Annals of Radiation," should be required reading.

Mac Peirson W6QBW
West Hills CA 91307

A book on my shelf for many years, *Electromagnetic Fields and Life*, by A. Presman, a Russian biophysicist, published by Plenum Press in 1970, is an overview of work done worldwide in frequencies from DC to SHF. Presman has citations going back to 1926! Nothing new here.

I was particularly interested in Brodeur's comments regarding ELF modulation of 2 meter RF emissions and the effects on the brain. Another fellow, Robert A. Monroe, author of *Journeys Out of the Body*, has developed and patented a technique for impressing 5–10 Hz waves on the brain, using an audio modulation technique he calls "Hemi-Sync." His purpose is basically to set up a mental environment favorable to such activities as out-of-the-body travels, stress reduction, skills improvement, and learning enhancement. The point is that we have clear evidence that ELF signals not only have biochemical effects, but that they also modify our mental/behavioral states.

Since we've been subject to these fields for several generations, there is considerable reason to suspect that many of the things we bitch about are the result of this exposure. I refer specifically to the apparent decline in our mental faculties, as evidenced by lower SAT scores, rotten school graduates, and the general apathy and malaise we see about us.

Why do we old farts seem to be the only ones who have any fire anymore? Because the *rate* of damage is increasing. When we were kids, residential load centers were typically rated at 40–60 amps or less. In the '50s and '60s, 100 amp load centers were specified, and now they're up to 200 amps.

You'll remember the oft-stated theory about the decline and fall of the Roman Empire being due to the use of lead water piping and the consequent brain damage over an extended period. Isn't it an interesting parallel?

The California Public Utilities Commission has come up with a 500-page draft report on the question, and I've ordered a copy. Your call for ham-designed Gaussmeters is a good idea. After all, we hams are the certified technical experts in our communities (most of us are just certifiable, I think). Where else can the public go for honest, unbiased information?

Tom R. Rice WB6BYH
Livermore CA 94551

Whoa, Tom, re-read my June editorial, "Oh, Darn, My Kid's Gone Bad," before giving 60 Hz magnetic fields credit for lousing up our kids. I suspect we parents are doing that through massive neglect, with no help needed from the power companies. . .

Wayne

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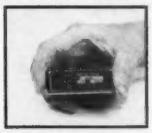

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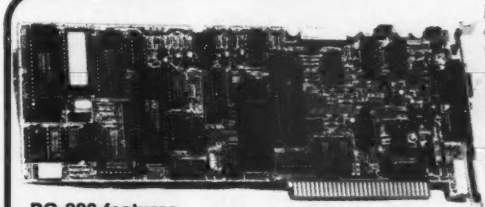

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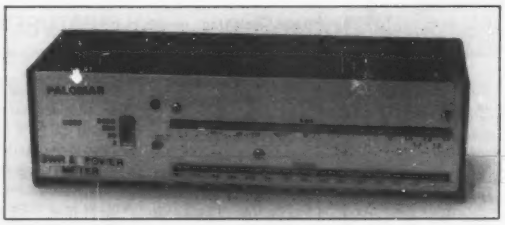
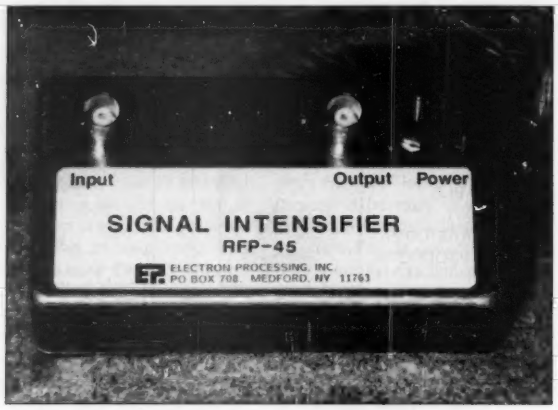


PRODUCT OF THE MONTH

PALOMAR ENGINEERS SWR & POWER METER

Palomar Engineers announces a new deluxe SWR and Power Meter, Model M-835, which gives accurate readings continuously, even during CW or SSB operation. It has four power ranges: 2, 20, 200, and 2000 watts. Both power and SWR are displayed continuously on 6" light bars with 3% resolution. The M-835 operates from 1.8 to 30 MHz, and requires 12V DC.

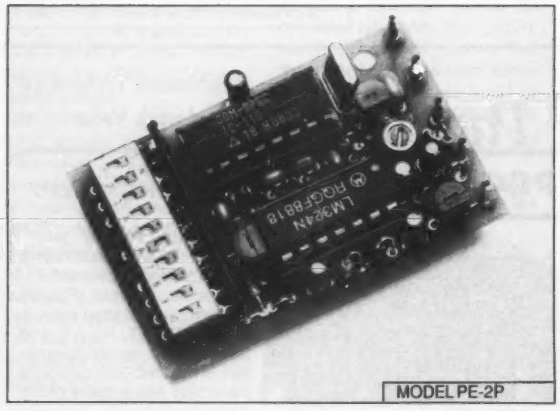
The meter sells for $190. The AC adapter is $15. Send for a free catalog from *Palomar Engineers, PO Box 455, Escondido CA 92025. Tel. (619) 747–3343.* Or circle Reader Service No. 201.



ELECTRON PROCESSING, INC.

Electron Processing announces the first battery-powered receiver preamplifier, the RFP-45, easily tailored to almost any installation. Housed in cast aluminum 2.5"x4.5"x1.5" with improved lightning/static protection, the RFP-45 provides 15 dB of gain from 1 MHz–1300 MHz, with a low 2.8 dB noise figure. This signal intensifier, powered by two 9V batteries, covers MF to UHF frequencies. The RFP-45 is perfect for portable use when AC power is not available.

The RFP-45 is $100, with quantity discounts. The price includes your choice of BNC, SO-239/UHF, or F connectors. *Electron Processing, Inc., PO Box 708, Medford NY 11763. Sales Department, (516) 764–9798.* Or circle Reader Service No. 203.

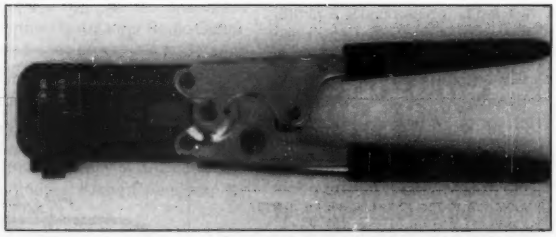


COMMUNICATIONS SPECIALISTS, INC.

Communications Specialists announces their new PE-2P DIP switch programmable Two-tone Sequential Encoder, designed for mounting inside a radio. It lets the operator send a single two-tone sequential paging call. With standard 1–3 second timing, the PE-2P is compatible with Communications Specialists SD-1000 Two-tone Decoder and other systems, such as the Motorola Quick-Call II, 1+1, and GE Type 99. You can change the timing to match other two-tone formats.

Tones A and B are DIP switch programmed from a 32-tone memory base specified when ordering. Over 1000 combinations are possible from a single PE-2P. With added circuitry, you can wire the PE-2P for multiple calls. The PE-2P, powered by +10–16V DC, measures 1.25"x2.0"x0.4". A momentary ground activates the selected call. A 150 mA output keys PTT.

Price, $55. *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296. Tel. (800) 854–0547 or (714) 998–3021. FAX (714) 974–3420.* Or circle Reader Service No. 202.



NEMAL ELECTRONICS INTERNATIONAL, INC.

Nemal Electronics International presents a new ratchet crimping tool for use in the communications and computer fields. The tool offers full cycle ratchet operation with machined dies for precision crimping and long service life. It features a pin holder and wire locator for easy operation. Part number CT2320 accomodates wire sizes from 20 to 30 gauge.

Price, $95. *Nemal Electronics International, Inc., 12240 NE 14th Avenue, North Miami FL 33161. Tel. (305) 899–0900. FAX (305) 895–8178.* Or circle Reader Service No. 204.

ADVANCED ELECTRONIC APPLICATIONS, INC.

AEA announces MACKRATT with FAX, a computer program for the Apple Macintosh, to enhance PK-232 use. MACKRATT, running the PK-232 in host mode, makes it fast and easy to use all the powerful features of the PK-232. It provides windows for entering text, displaying data and file transfers, and logging transmissions. Ten macro keys simplify and speed data entry. Send RTTY, AMTOR, and CW a character at a time. Runs under MultiFinder. You can send FAX images to the printer without changing cables.

MACKRATT with FAX works with the Macintosh 512K, 512e, Plus, SE, and Mac II. Price, $60. *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036. Tel. (206) 775–7373.* Or circle Reader Service No. 207.

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DX from the Sky

Working DX via satellite is inevitable if you make any contacts at all via AMSAT-OSCAR-13. Pile-ups are few, even on the "rare" ones, and conversations with foreign stations are more relaxed than those on HF.

Working 100 countries via satellite, however, is not easy. Two factors not encountered on the low bands work together to make SATELLITE-DXCC a real challenge.

The specialized equipment for transmitting on 70 cm and good reception on 2 meters for A-O-13 Mode B operation is not common in many poorer, third-world countries. The technology for operation on the shortwave bands is quite simple and inexpensive in comparison. A dipole antenna and an old solid state transceiver with a battery are all you need to get a remote location on the air.

The other factor is interest. Working western Europe and Japan via A-O-13 is as easy as working New York and California. Interest is high, equipment is available, and operators are plentiful.

Sometimes only a few operators with a keen interest in the hamsats will provide all of the contacts for an exotic location. Operators like Jon OY9JD, Jean-Louis TR8JLD, and Ron YJ8RG have helped many DX chasers get a new one.

When a DXpedition takes to the airwaves, the satellite operation is usually secondary or nonexistent. It seems that when one does provide an OSCAR position, a well-known satellite enthusiast is involved. Examples include Pascal HB9RHV in Liechtenstein, Beni HC1BI in the Galapagos, and Pedro CE3BFZ on Robinson Crusoe Island in the Juan Fernandez group. We greatly appreciate their efforts and the efforts of others like them.

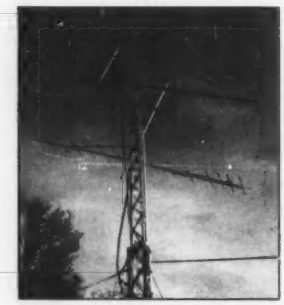

Photo A. Satellite antennas used at 4J1FS in late May for the DX-pedition to Malyj Vysotskij (M-V) Island. (K7JA photo.)

Malyj Vysotskij

In late May, 4J1FS showed up on A-O-13. The previous expedition to "M-V" Island in mid-1988 was well-documented in a feature article in the June 1989 issue of *QST*, but the earlier group did not make any satellite contacts. This time, with only a few days' notice and a "FAXed" visa, Chip Margelli K7JA, Yaesu USA Vice-President of Marketing, came along. Chip brought an impressive array of Yaesu HF and VHF equipment, including an FT-736R for satellite operation.

M-V Island is located near the south end of the Saimaa Canal in Soviet territory near Finland. The DXpedition team was Finnish, Soviet, and American, with Chip of Southern California. The Soviet Radio Sport Federation and the Finnish Amateur Radio League sponsored the event.

While participating in the CQ WPX contest, the multi-national group made tens of thousands of contacts on HF. Several hundred contacts were also made via A-O-13. The FT-736R, rotors, and other gear had made the trip to the politically remote location intact. Chip's signal on Modes B and J (2 meters up and 70 cm down) was excellent. Anyone who wanted to catch the new one via satellite had only to call. There was even time for some casual conversation with many enthusiastic operators around the world and especially with his wife Janet WA7WMB back in Anaheim.

Photo A shows the impressive antenna array for the satellite activity. Although the multi-element yagi was horizontally polarized, the spin modulation was only pronounced when satellite pointing angles were not favorable.

Boris UW3AX (QSL manager for *Mir* space station contacts) got a firsthand opportunity to experience full-duplex high-orbit satellite activity with spin modulation during a session of A-O-13 activity. Wearing headphones, listening to the downlink with roundtrip time delay, and speaking a foreign language with signals rapidly fading in and out can be quite a challenge. Try it sometime!

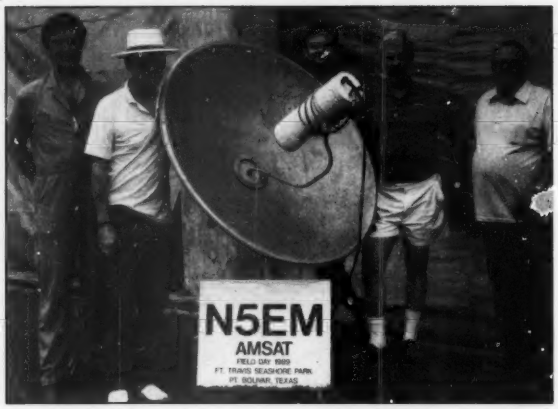

Photo B. The Mode L uplink antenna and some of the crew at the N5EM Field Day station. From L to R: WA5ZIB, N5LKJ, WB5HLZ, N5EM and N5HQM.

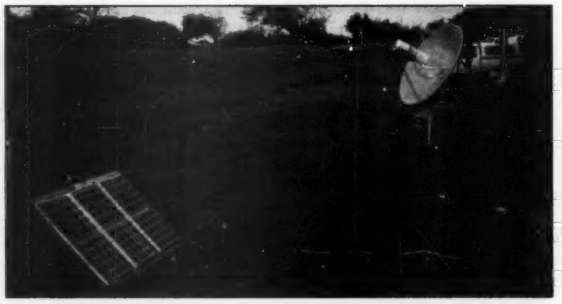

Photo C. Battery power with solar charging and Mode L operation with a four-foot dish at the N5EM Field Day site near Galveston, Texas. (N5LKJ photo.)

Field Day Operations

The description of our Field Day activity from South Texas with Mode L (23 cm up and 70 cm down) in the August "Hamsats" resulted in photo requests from several satellite chasers contemplating similar activities from portable locations. A few stations also operated Mode L on Field Day, but with yagis or helix uplink antennas. The simple four-foot dish with coffee-can feed provided our group with remarkable uplink signals using only 35 watts of microwave energy.

The feedline, pointed by hand, was kept short (Belden 9913). After aiming the dish in the same direction as the downlink crossed yagi, they made minor adjustments by monitoring a transmitted carrier from the dish through the satellite on the downlink receiver. At the highest S-meter reading, they secured the dish fast with elastic cords and vice-grip pliers. No further adjustments were required during the 90-minute Mode L period.

Many groups throughout the country noted good conditions and record numbers of contacts via A-O-13 and RS-10. With several new satellites scheduled for launch during the latter part of this year and early in 1990, Field Day next June could be more hectic and exciting than HF.

AMSAT-NA Annual Meeting

The 1989 AMSAT Space Symposium and Annual Meeting will be held in Des Moines, Iowa this year. Hosted by the Central Iowa Technical Society (CITS) and celebrating the 20th anniversary of the incorporation of AMSAT, the event is scheduled for November 3rd through the 6th. The committee in charge of organization has arranged for a full weekend of AMSAT activities with low attendee cost as a primary objective.

There will be informal gatherings, presentations of technical papers, a banquet following the annual meeting, and a Board of Directors meeting extending into Monday, November 6. The annual gathering was originally scheduled later in November, but possible conflicts with the launch of the Microsats required a change in plans.

the Meredith Corporation at 1716 Locust Street in Des Moines. Chartered bus and the CITS transportation committee will provide transportation between the Hampton Inn and the Meredith facilities (a ten-minute drive).

This year, seminars will be presented in a single-track schedule. Attendees will not have to miss a

"When a DXpedition takes to the airwaves, the satellite operation is usually secondary or nonexistent."

The primary hotel is the Hampton Inn, 5001 Fleur Drive, Des Moines, Iowa 50321. Call 1-800-HAMPTON to make reservations. AMSAT reserved the entire hotel and secured excellent rates for those mentioning the RAS GROUP when making reservations. The room rates include transportation to and from the Des Moines airport (a five-minute drive), complementary breakfast, free local calls with in-room movies and plenty of free parking.

Seminars, Saturday lunch, the evening banquet, the annual meeting and the first Board of Directors session will be held in the executive conference facilities of

thing. Informal sessions of the field organization and command station development program will be held during the wee hours in the Hampton Inn hospitality suite.

Door prizes are always abundant at the AMSAT Annual gatherings, and the subject material of the presentations is exceptional. The $20 registration fee includes a copy of the symposium proceedings. To get more details and an official registration form, contact: Ralph Wallio W0RPK, CITS Chairman for AMSAT '89, 1250 Highway G24, Indianola IA 50125. Be sure to send Ralph a self-addressed stamped envelope. I'll see you in Des Moines! 73

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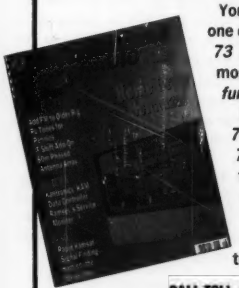

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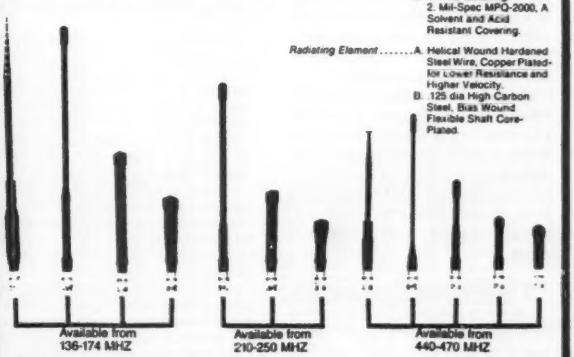

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Continued from page 8

and homeless problem. This would put hundreds of thousands of bureaucrats out of work, cut our unemployment rate substantially and make it possible to reduce taxes. It hasn't a prayer.

Drugs

Ditto my fiendish plan for solving the drug situation. This would quickly cut the American crime rate about 75%, putting policemen and lawyers in unimaginable numbers out of work. It would virtually destroy organized crime. It would wreak havoc with Colombia, Peru, Panama, many Caribbean countries and devastate South Florida. It would force black kids to reconsider school as a career path. It would also cut the heck out of donations to Congress. Let's not upset the boat with any new approaches to drugs. Let's send troops to Colombia. Let's continue to say no-no to our people who are anxious to louse up their lives with drugs. And let's make sure there's so much money to be made that we have an unending source of criminals to feed our "justice" system. It's better to spend $35,000 a year keeping someone in prison than to give him $25,000 to do nothing except keep out of trouble, right? No, I'm not suggesting that as a solution to anything—it's just to show how ridiculously we often spend our tax money.

As a five year goal I've decided to see what I can do about the music industry. It's a mess. Six international megacorporations have managed to organize a cartel which has 96% of all music (record) sales. That leaves about 10,000 independent record companies (indies) which are splitting the remaining 4%. That stinks.

How can I fight these multi-billion dollar international companies? By getting the thousands of indies to cooperate and fight together. So I've formed a group of about twenty new companies which will attack the cartel problem on every side. Each will get the indies to cooperate in some specific area. One will help get indies more airplay on the radio. Another will coordinate their PR efforts. Another will get them more coverage in newspapers. Another sets up a mail order company to handle hard-to-find CDs and cassettes. Another will act as a completely new type of distributor to get indie music into your local record stores.

If I see any clear signs that amateurs are at all serious about wanting to save the hobby or that the ham industry is willing to cooperate for this goal, I'll be delighted to help in every way I can. In the meanwhile I'm making notes for a book on how amateur radio was lost, and what this loss means to America's future.

The Save 220 March

Unless you've been hiding under a rock, you're aware of the recent "Great March to Save 220." With less than 150 hams bothering to participate, the term "great" may be an exaggeration. The "Great March" had two results—first it showed that "most hams aren't alarmed if their bands go away. It's too much trouble to care." That's a quote from Westlink, by the way. Secondly, the "March" did have the intended effect of further alienating the FCC, the group which has the power of life and death over amateur radio. Just what we needed, a further angered FCC. And what great timing, just as the new commissioners are being sworn in! The "March" was a disaster in conception as well as execution. Great work! And no, the ARRL did not think up this debacle.

What should we do? I suggest you take a good look at the list of firms and clubs who have supported the NIAC approach and get after those who have so far refused to invest $100 toward protecting our future. Once the new Bush appointed commissioners are in place, we need to have an industry team meet with them and bring them up to date on the critical importance of amateur radio to our country, both as a source of engineers and technicians, and as a resource in time of emergency. Check the *73* ad index for NIAC supporting firms.

Demonstrating in front of FCC offices and suing the FCC aren't likely to help preserve our bands. Talking reason will generally beat the heck out of threats and punishment. There are some good positive reasons why the FCC should be working with us toward rebuilding our growth, but without any dialog everyone will likely be a loser.

I've had enormous success in the past with making appointments with the commissioners, flying down for the day and sitting down with them for a couple hours. I've always found them hungry for information and interested in helping, once they understood what's involved.

With all due respect to the League—and I can understand their anger and frustration over what's happened—their approach of confrontation with the group which has the power to eliminate our hobby, seems ill-considered. What we need is diplomacy, not an expensive and winless war. Yes, there I go, bad-mouthing the ARRL again. And right after they sent me a beautiful 50-year membership plaque, too! What an ingrate! Let me put it this way, do you think the League is going the right route to sue the FCC instead of trying to use diplomacy? Leave my opinions out of this entirely. Forget 'em. What do *you* think?

Hey, I've been supportive of the ARRL no-code plan, haven't I? Well, yes, I have hinted that their plan falls about 99% short of the target, but at least they're shooting in the right direction, even if they're using BBs when we need a Stinger missile.

The 14,313 Mess

Speaking of missiles, we seem to need some help on 14,313 kHz. I've been trying to find out what's going on there, but the reports are confusing. I gather there are several nets around the world which time share the channel. But for some time they've been complaining about getting jammed by KV4FZ, who seems to have earned international condemnation for his efforts. Pity, cuz Herb used to be one of the good guys, but that was a long time ago.

Even worse, Glen Baxter K1MAN, a chap I cannot describe easily in a family magazine, apparently not satisfied with the enemies he's made on 14,275, has moved into the 313 mess. Glen and his IARN may be doing some good now and then, but my experience with what appears to be an all-mouth-no-ears personality may have blinded me. I get the impression that he'd like to be a ham version of Yassir Arafat.

I'll put my money on Ed Ricca K4PT, who's been running the International Phone Net on that frequency for years. Ed's an old friend from Brooklyn, back in late 1945, right after WWII. I had many a midnight coffee and danish with Ed and his wife Jeannette at the W2OCL shack in the late '40s.

I've so far resisted putting my kilowatt on 14,275, starting a few minutes before K1MAN, and broadcasting endless tapes of stuff of interest to amateurs—a sort of *73 Magazine of the Air*. Let's see, we could run my last 38 years of editorials, all read in an enthusiastic way by me. You certainly wouldn't want to miss out on a list of all known hamfests for the next 30 days, right? And perhaps a list of the articles appearing currently in all of the ham magazines. You won't want to miss any DXpedition news, naturally. Then we could get into commentary tapes from listeners with their views on my editorials. All this is well within the FCC guidelines for legitimate broadcasting.

But what if Glen turns on his rig without listening and interferes with my 275 transmissions? Mercy! Well, I certainly don't want any hams around the world to miss my incredibly important information, so the obvious answer is to have someone at a distance check the channel and, should unintentional interference come from K1MAN, because he "forgot" to check the channel before broadcasting, develop, I could fire up a second kilowatt on a nearby channel. I've got several kilowatt rigs I could get on line here, each with a nice sloper dipole for relatively non-directional coverage. I think I can get more kilowatts on the air than Glen.

Check out 14,275 and 14,313 and let me know what you think I should do. Will I serve you best by going on a DXpedition and skin diving trip to the Caribbean or by zapping a few 20m frequencies with endless ham-oriented news broadcasts? Or would you rather have me send 24 hour-a-day RTTY information bulletins on 275? Please advise.

Yes, I know there'll be a few drug-crazed or CW brain-damaged old hams who will wonder if I'm really serious. Hey, they don't give intelligence tests with the ham exams, right?

Fast Driving And DXing

Some readers have been fussing with me for driving fast and thus needing a radar detector. After all, they say, if you drive slower you'll still get there, it'll just take a few minutes longer. And besides, everyone knows that speed kills, right?

Rather than buying a knee-jerk agreement with all that, I prefer to approach the problem with reason. I've put over 120,000 miles on my Toyota van in the last six years—that's 20,000 miles a year. Okay, if I stay within the

20m Fire Breaks Out

The FCC reported that a fire of suspicious origin broke out on 14,219 kHz on September 27th at 0150Z. The fire was first thought to have been caused by too many California kilowatts in a pileup calling (or trying to drown out) a DXpedition on that channel.

An FCC spokesman said that a careful examination of what was left of the frequency gave clear indications that this was not spontaneous combustion, but a deliberately set fire—possibly intended to prevent further communications with a DXpedition. Two well-known California DXers are being investigated. Both had made one original and two safety contacts with the DXpedition, so the motive may have been an attempt to prevent other DXers from contacting this new country.

The fire started in the Los Angeles area and quickly spread to Texas and several Pacific Islands. The fire, which started on 14,219 kHz, also damaged several adjacent channels. Only quick action by several volunteer DX groups prevented the gutting of the entire 20m band.

Bill Pasternak WA6ITF has already spearheaded a salvage effort asking for donations from DX groups to help repair the extensive damage done. Money is desperately needed, and fast. If the weakened superstructure on 14,219 isn't replaced quickly, it's possible that the entire band could collapse. All it would take at this time would be an ill-advised ARRL contest or the cumulative impact of several simultaneous DXpeditions. This could leave us with nothing but a burnt out hole on our dials.

Amateurs are asked by the FCC to avoid going within 10 kHz of 14,219 for the foreseeable future so their inspectors can check for clues to the perpetrator. This will also help keep the frequency clear for emergency repairs.

Two or three Extra Class DXers have been arrested for scavenging through the rubble, apparently looking for partially burned Hertz which they might steal. With even old, badly worn Hertz having a market price in the tens of thousands of dollars, it was difficult to keep the scavengers at bay.

Westlink reported a 73-point drop in 20m stock as a result of the fire. This brought 20m stock below that of the 2m band for the first time since the sunspots went above 50.

The ARRL, possibly over-reacting, issued a bulletin asking their Official Observers to police the band, requesting all amateurs to avoid using 20m until the FCC feels it's safe. The RSGB announced they would cooperate with the ARRL. The REF said French amateurs would continue to use 20m, that a fire in the US was of no concern to them. After all, few French amateurs bother to work US amateurs anyway.

Reports that the PLO had claimed responsibility for setting the fire have been discounted by the CIA.

White House Chief of Staff, John Sununu, assured reporters that President Bush is deeply concerned and extends his condolences to the families of any amateurs hurt in the disaster.

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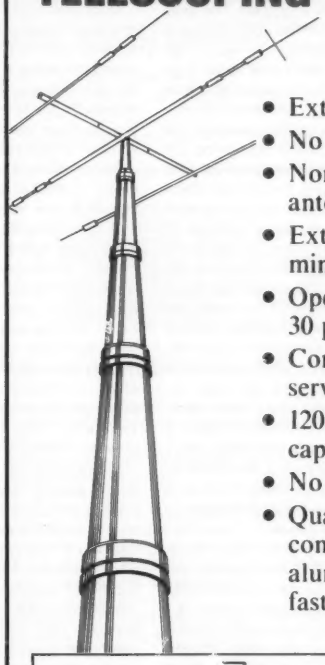

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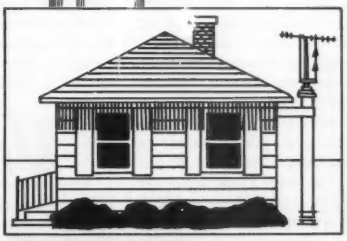

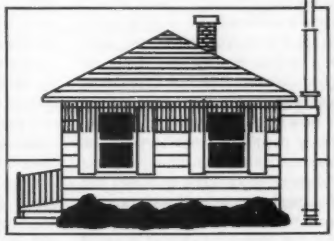

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CIRCLE 105 ON READER SERVICE CARD

speed limit around Peterborough, where I do most of my driving, I'll maybe be able, on better days, to average 30 mph. That's 660 hours a year on the road.

If I just pep that up to a 40 mph average it'll take me 500 hours a year—a saving of 160 hours. That's four work weeks! In other words, by pushing a bit I'm able to get in an extra month of work more than my dawdling neighbors. That isn't the only way I save time, but people are always asking how I can get so much done compared to most other people. By not wasting as much time, that's how.

If I push the van a bit harder I can average 50 mph, cutting my driving down to 400 hours a year - saving another hundred hours—two and half more weeks of work. So I try to average about 50—and succeed pretty well, thanks to my radar detector.

Now how about the danger of driving fast? As I recall, over 85% of the fatal accidents happen under 40 mph. Thus, by never driving under 40 mph I'm able to cut my chances of having a fatal accident by 85%. I like those odds—like 'em a lot. Since 65% of the accidents involve alcohol, and not only do I not drink, thereby cutting out at least half of that kind of possible accident, I drive very defensively, making it difficult for a drunk to hit me, even on my side of the road. Several have tried.

Driving faster also has the benefit of exposing one to the dangers from other drivers for a shorter time. Let's not reduce that to absurdity by going through intersections at 100 mph and hoping for the best.

I save time many other ways. I watch more TV than you may think I do, cutting the time by taping everything. Thus I speed through the program openings, commercials and closings, getting me down to around 45 minutes per hour program.

Shaving in the shower saves a few minutes a day, plus I get a far more comfortable shave. A few minutes a day—big deal, right? If I save just seven minutes a day by changing small routines like that, I've got an extra 40 hours a year - an extra week for work or even a ski trip that you don't have.

By having an office at home where I do most of my writing, I save on commuting time. Oh, I have to drive to my publishing offices a couple times a day—a six-minute trip. In good weather I do it on my Yamaha scooter, which is a bit faster than the van. In the van I get double use of the time by reviewing new CD releases while I drive.

How much time could you save by really paying attention to it? If you aren't by nature a fast driver you probably shouldn't save time by driving fast. But there are plenty of ways you can save time when you give it thought. If this just means being able to watch another sitcom a day, why bother? But if it means being able to start a small business at home which could eventually make you independent . . . ? All it takes is an idea and the guts to give it a try. So let's not hear the old saw that you don't have time . . . okay? The least you can do is read a few more books and magazines, thus adding to your work skills and making you a more interesting person to talk with on the air.

If you have enough money to buy all the ham gear your heart desires, then save time so you can get a signal on through a ham satellite—now there's a real challenge! Or how about setting up a 220 repeater cross-banded to 75 meters so Novices will be able to join in the round tables?

But, Is It Legal?

A recent letter said that many hams who apparently live very isolated lives are unaware that it is completely legal for Novices (or any other class licensee) to be repeated on the low bands and make cross-band contacts. Preserve us from the Nervous Nellies who wring their hands in anguish . . . "Golly, do you really think it's legal? Maybe we better get a letter from the FCC saying it's legal before we do that."

For the tenth from last time, if you don't know the ham rules yet, then please read 'em so you will. The basic law of survival with the FCC is simple: If it isn't prohibited, it's legal. That means if you aren't sure about it, go ahead and do it until you get an official complaint from a monitoring station—which is most unlikely because the FCC doesn't bother monitoring the ham bands much these days. Perhaps it's too depressing. If you do manage to get a citation, you can apologize—if they can cite an actual rule against what you've been doing. The positively worst thing you can do is ask first. You certainly should know enough about bureaucrats by now to know that they're never going to risk their careers by making decisions which could ever be challenged. So when you ask, the answer will always be the same: no. Then something which might never have been questioned because it wasn't prohibited is now illegal. Don't ask. And if you have a friend who insists on asking, convince him to do it your way. Use force, if necessary. Whatever force it takes.

If you do take this time thing seriously and free up previously wasted time, may I suggest for the umpteenth time your finding a youngster to Elmer? I can't help but think of Bill Welch W6DDB and his wife Marie W6JEP, who have brought thousands of Novices to our hobby. As far as I know, no one even comes near Bill and Marie in developing and licensing Novices. But it's worth trying to beat them.

The new Novice voice privileges seem to be making a difference, so let's take advantage of this and build momentum. If you have a radio club in your area—and most of you do—it's time to start going to meetings again and get the club interested in bringing in Novices and setting up Novice classes.

If the club repeater doesn't have an input in what's left of the Novice 220 band, get it set up so they can work each other on 220 and also get through to the 2m repeater. A cross-band system to the lower bands is more difficult, but will be great fun—and not just for the Novices.

Back before the FCC made it illegal, my WR1AAB repeater cross-banded to 10m and made it so hundreds of New England Techs were able to work all around the world. When the FCC outlawed it, I organized an FCC oral hearing (1974), bringing in repeater spokesmen from all around the country to testify. This hearing resulted in the deregulation of amateur radio, the largest change in FCC regulations ever—and cross-banding was once more legal. This triggered the whole FCC deregulation movement.

If you have some club members who don't want Novices bothering them, see what you can do to bring the curmudgeons around. It's probably too late to change some. Many people are so used to being negative and sour that they are frozen in that mode. They aren't much fun at club meetings, at home, to work with, or on the air. Happy people are not only more fun, they live longer and are much more successful.

Much of life calls for salesmanship—at home it makes life simpler, at work, whether you're on the line with customers or managing people, it's salesmanship that wins. That's the essence of "How To Win Friends," a great book you should get your kids to read, even if it's about 50 years old now.

Salesmanship is finding a way to get people to want to do what you'd like them to. It's the only way you can train animals successfully, and it works just as well with kids and club members. I've got three retired racing greyhounds which are fun to work with. You can't force a greyhound to do anything—they just look martyred and lay there. But they'll do anything you want once you've convinced them it's just what they wanted to do. How do *you* go about getting people to do things? Your wife? Your kids? Your employees? Your supervisors?

On the air are you fun to talk with or are you sarcastic and easily angered? Do you tend to be a "no space cadets" op, a la the infamous W2OY? Or perhaps an op who gets pleasure out of jamming medical emergency nets like W2BIB did? A sanctimonious repeater control op can precipitate endless jamming and kerchunking in retribution, making life miserable for everyone.

No, you don't have to gush love over the air. Just be nice, even when it's hard to do. When you're frustrated, it's difficult to remember to be nice. It's awful to hear a rare DX station talking endlessly with someone and not standing by so you can break in. You know the band is going to change and you're going to lose out. Talk about frustration!

Or you chance upon a list operation working one you desperately need. A half hour fighting a pileup to get through to a DX station is bad for you, for the others in the pileup and miserable for the DX op. It's a lose-lose-lose situation until you crush or outsmart the others and get through and make your silly ten second contact. The eventual contact is never going to bring back the hours you've shortened your life by being frustrated and angry.

Medical science (all too often an oxymoron) agrees that negative emotions suppress the immune system, opening you to whatever bug or virus happens to be present. A study by Dwight Bulkley showed that every illness can be traced back to a drop in the immune system's power, usually triggered about 33 hours earlier by an emotional trauma. Oddly enough, he also found that many accidents could similarly be traced to a delayed reaction to earlier traumas. That fender-bender, stubbed toe or cut finger can be a reaction to your anger over a net jammer a day and a half ago.

There's much to be said for learning to avoid things which upset you. I wonder, if this ever became widely known, would it end DXing and contests?

One more thing, while we're discussing ham frustrations. An old time ham (what else is there?) was concerned about our encouraging so many new Novices. Won't that make our already full bands even worse? Obviously he hasn't been reading my editorials. No, if we can get a few more on 20m, perhaps it'll get more old timers in a frame of mind to encourage new communications modes. I explained how we could easily develop voice systems which would permit a thousand or more times as many contacts in the same bands, with less interference. The technology is there, we just haven't bothered to develop it. Perhaps we're waiting for the Japanese to do it for us.

Though most of the Spark-Forever hams have won their Silent Key certificates, we're still hearing an occasional surviving AM-Forever. When we get some new modes going, we'll start hearing SSB-Forever and FM-Forever. Sigh. The upside is they'll shorten their lives and thus not annoy us for long.

UPDATES

Number 33 on your Feedback card

UNIDEN HR2510 POWER MOD UPDATE

Due to a technical inaccuracy in my original test set-up, the PEP power levels on page 48 of Sept. "*73 Amateur Radio*" were erroneous. After revamping the test bench equipment, and testing the new wattmeter against a Bird 43, the findings are as follows: in modified radios, 2–3 watts carrier, and 10–12 watts PEP average increase over the stock peaked-out radios. Therefore, the original goal was reached, i.e. more power with better audio, and less stress in the RF output section.

I sincerely apologize to everyone who may have been inconvenienced by the original results printed. With regards to all, M.T. Stacey, KC4HGH.

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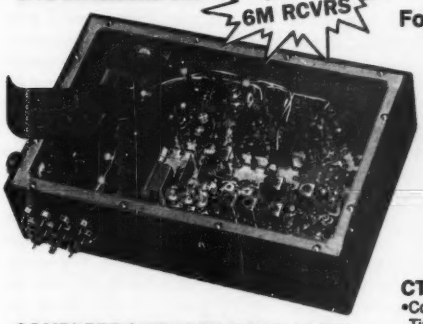

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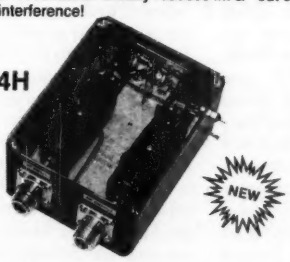

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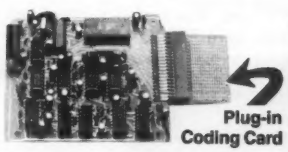

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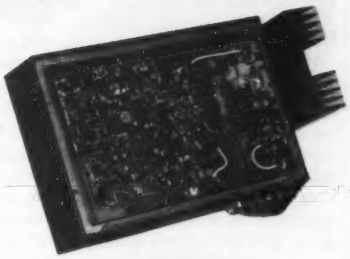

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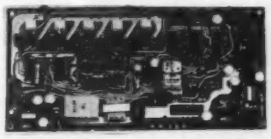

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RTTYers Speak Out

The readers of this column are a vocal lot! I was both overwhelmed and gratified by the response to the survey I published here a few months back, and I didn't anticipate so many responses.

To begin with, and it's no big surprise, 94% of you are active on RTTY, with the rest interested in getting on in the near future. Only about 30% of you are using mechanical teleprinters, however, with the rest describing various computer configurations. There were no responses from those who were using a dedicated electronic RTTY terminal.

RTTY Systems, Software, and Bands

Among mechanical teleprinters, several of you are using Model 28-ASR machines, and others are using Models 28-KSR, 28-RO, 32-KSR, and 35-ASR. Isn't anybody using a Model 15 any more?

Computers used for RTTY were even more diverse. While Commodore C-64s lead by a few percentage points, there are plenty of PC-XT and PC-AT clones, Tandy 1000s, TRS-80 Models I and III, Apples, Amigas, CoCo 2s and 3s, and even an SSB Chieftain.

With all these systems, it's no shock that the number of programs is even more varied. Some of them, such as the AEA or Microlog programs, are well-advertised, commercial programs. But others, such as YAPP, Super RATT, Mickeyterm, RTTY 1-1, and homebrew OS/9 terminal programs, keep many of you on the air.

As to bands of operation, you are really spread out, with 78% on 20 meters, 64% on 10, 50% on 15 meters, 35% on 80 meters, 35% on 2 meters, 28% on 40 meters, and about 7% on 12 and 18 meters. Of course, this adds up to much more than 100%, as most of you operate more than one band.

Coming Attractions

I asked what you would like to see in RTTY Loop, and the answers, again, were spread all across the spectrum. Leaders were requests for information on AMTOR, and more construction and/or modification projects. We have had some material on AMTOR, and the several construction projects featured recently have just been the tip of the iceberg.

Other topics you would like to see include: SWL reception and bit inversion decoding, packet operation, weak signal techniques, details on older machines (this in spite of the apparent dearth of such machines in use), the history of radioteletype, getting started in RTTY, operating techniques, mailbox access, and software sources.

Some of you commented on the difficulties folks are having putting older equipment, like mechanical teleprinters no one is using, with some of the terminal units, such as Flesher or HAL. Sources of wiring and interconnection information on these units are few. While we have covered some of this in the past, I don't know whether I have addressed every possibility. Check back issues of RTTY Loop, either in the library or by perusing the RTTY Loop Index, to see if the problem was described. If so, check that issue; if not, drop me a note with your specific problem.

Make Docs Simpler

Over the past several years we have seen an influx of manufacturers targeting the RTTY market. The comments and complaints I received concerned the quality of documentation supplied with otherwise excellent hardware. It's now relatively easy for newcomers to ham radio to access many digital modes using inexpensive interfaces. The documentation for many of these devices, however, doesn't target entry-level users.

The manufacturers should address this problem by packing some elementary and background material along with the sophisticated literature that comes in these super-boxes. Even I am befuddled by some of these manuals sometimes! Look for entry-level info on the setup and use of these TNCs and data controllers in future columns.

Speaking of befuddlement, another of you elaborated on the confusion on the bands between the 60 speed and 100 speed crowds. This person felt that the biggest pain in the neck on RTTY today is having to constantly switch speeds just to see what is happening, and he believes that we should set 100 speed as the standard because of the many computerized RTTYers out there.

Setting a standard is an excellent idea. On the other hand, however, if we set a 100 speed standard, it would shut out maybe a third of the hams presently on RTTY and make a great deal of inexpensive equipment obsolete. Such equipment often represents the only viable way for a neophyte to approach RTTY. Let's hear from you about this!

Another comment concerned quite a few Commodore C-64 users who are using one of the newer multimode terminal units, and are generally dissatisfied with the terminal program they are using. Jack Skubick K8JS suggests using a public domain program called THIRDTERM. This menu-driven program is said to have logical keystroking, support for most printers, a large capture text buffer, and professional operation and screen appearance. He is willing to send the program to any user who sends him the princely sum of $3. Address it to Jack at 791 106 Ave., Naples, Florida 33963, and tell him you are interested in THIRDTERM, as described in this month's RTTY Loop.

One final note from the pile. It appears that Amiga users are on the rise, with Amiga Users' Nets on 10 and 75 meters, as well as some on 20 meter AMTOR.

Venerable Mode

One of the reasons I published this survey was to get a sense of just how active the RTTY segment of amateur radio currently is. As a facet of the hobby which has its roots back some forty years or more, RTTY predates SSB and FM on a practical level. Only CW is an older popular mode. RTTY shows its age well, continuing to provide both the newcomer and old timer with a unique, fascinating mode of communication for practical service, such as passing messages, and strange entertainment with RTTY pictures and bell songs. RTTY is also a good introduction to the wonderful world of digital communications.

I hear you, and will take the cue to cover all this, and more, in the months ahead. As always, feel free to drop me a note at the above address, or send electronic mail on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). A self-addressed, stamped envelope will get you an index to past editions of RTTY Loop.

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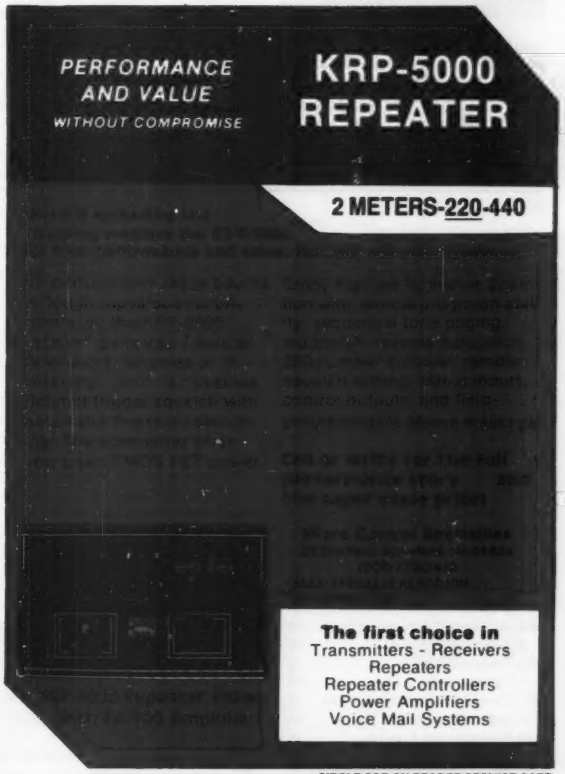

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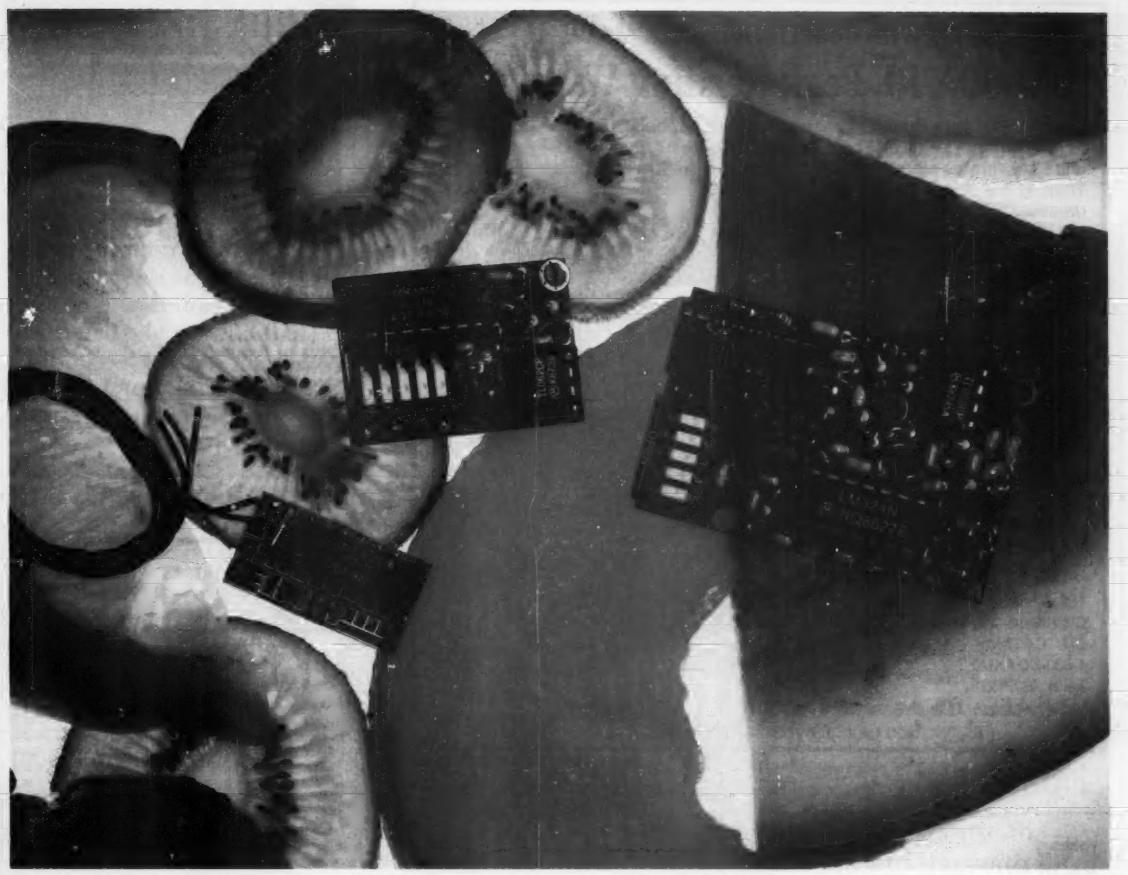

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73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

As we come closer and closer to the European Economic Community and the development of a more open economic system, what will happen to prices of ham radio related equipment? By comparing the present prices of ham equipment and other consumer goods (after conversion to the Yankee dollar) in the European area, and like items in the USA, we can generalize that the European-sold goods are one and one-half to two times (or maybe even more) more expensive.

It also appears that we are becoming more appliance-operator oriented rather than home-brew oriented. With the high cost of buying the newest manufactured ham goods, are we shooting ourselves in the foot? Are our attempts to increase the numbers of young hams being hurt by the high cost of equipment?

For those of you closest to that market, please keep us informed on your observations of the "new economy" as it develops.

Roundup

Australia. From *Amateur Radio* (Australia) via Ken Gott VK3AJU, Federal Awards Manager: "Are the glasnost' and perestroika policies of Soviet leader Mikhail Gorbachov having an impact on amateur radio? I think perhaps they are."

Ken reports receiving his R6K award a couple of weeks ago. Is that remarkable? Yes, because the package was sent directly to his QTH, something that wouldn't have happened several years ago. They would have been stockpiled, and posted in bulk at annual intervals to the WIA Federal Office.

[*It's very nice to see direct communications by more than just the airways.—C.C.C.*]

Ireland. Congratulations to Dave Moore EI4BZ, editor of the *Irish Radio Transmitters Society Newsletter,* on his receipt of the Arup Cup from the Society in honor of his efforts in producing the monthly newsletter.

[*It's always a pleasure to read a well-prepared newsletter, and Dave certainly deserves recognition.—C.C.C.*]

Switzerland. The 13th Plenipotentiary Conference of the International Telecommunication Union (ITU), which met for almost six weeks (23 May–30 June) at the Acropolis in Nice (France), drew to a close with the signature of the Union's new Constitution and new Convention on the evening of Friday, 30 June.

Over 1,000 delegates from 143 of the 166 ITU Member countries attended the Conference, as well as observers from other international organizations.

The Conference, which is the ITU's supreme body and meets every five or six years, had to adopt a Constitution and a Convention to replace the International Telecommunication Convention adopted at Nairobi in 1982, an international treaty binding upon the States Members of the Union.

The Conference also had to review the structures, methods and resources of the ITU with a view to securing the operation and development of world communications in the 1990s and beyond. Telecommunications technology has grown more vigorously in the seven years since the last Plenipotentiary Conference than in the previous 70 years. The Conference was therefore required to make decisions crucial for the future of the Union and international telecommunications, in the fields of frequency sharing and use, regulation of services, standardization of communication equipment and systems, and telecommunications development in the Third World.

Seven Conferences were programmed by the Nice Conference for 1989–1995: (1) The Second Session of the Regional Administrative Conference for the Planning of VHF/UHF Television Broadcasting in the African Broadcasting Area and Neighbouring Countries (Geneva, 13 November–8 December 1989). (2) A two-day Regional Administrative Conference to abrogate the Regional Agreement for the African Broadcasting Area (Geneva, 1986), Geneva, 4–5 December 1989. (3) An extraordinary Plenipotentiary Conference (Geneva, two weeks) depending on the decision taken by the Administrative Council in its 1991 session. (4) A World Administrative Radio Conference on frequency allocations in certain bands: 2–30 MHz for additional allocations to the broadcasting service; 0.50–3.0 GHz for allocations to the land-mobile, mobile-satellite, direct broadcasting-satellite, space research and space operation services; and 11.7–23.0 GHz for allocations to the high-definition television broadcasting-satellite service (Spain, 1992, four weeks and two days). (5) A World Administrative Radio Conference on matters related to the HF broadcasting service, HFBC (Geneva, 1993, four weeks). (6) A Regional Administrative Radio Conference to establish criteria for shared use of the VHF and UHF bands allocated to the mobile service, the broadcasting service and the fixed service and, if necessary, to plan the broadcasting service in all or part of Region 3 and the countries concerned in Region 1, to be decided by the Administrative Council after consulting the Members concerned. (7) An ordinary Plenipotentiary Conference (Japan, 1994, five weeks), to be confirmed by the Administrative Council in 1991.

[*Within several of the above Conferences lie the possibilities of losing or gaining frequency spectrum for the worldwide amateur community. It behooves all of us to become known to our country's representative of the ITU and make our desires known. Also insure that your country's national ham organizations are aware of the importance of these conferences. As we gain more information on the ITU Representatives, we will put this info on the 73 BBS (603-525-4438, 300/1200 baud, 8 data bits, no parity, and one stop bit) for your viewing and/or downloading pleasure. You can also write:* ITU, Place de Nations, CH-1211 Geneve 20, Switzerland *for more information.—C.C.C.*]

USA. We received the following information about International Amateur Radio Network (IARN) from Glenn Baxter K1MAN.

"The primary purpose of IARN is to organize the amateur radio response during international emergency communications crises. The secondary purpose is to promote the utility of amateur radio in all areas, including public service, international good will, and education.

"IARN was born on September 19, 1985 with the devastating earthquake in Mexico City. The organization has also been involved in emergency communications with the volcano eruption in Columbia, the 1986 earthquake in El Salvador, the 1987 earthquake in Los Angeles, the 1988 hurricane Gilbert hitting Jamaica, and the 1988 earthquake affecting Soviet Armenia. Many other smaller scale emergencies have used the services of IARN. IARN has been recognized as one of the major worldwide organizations which manage multination amateur radio emergency response."

You can get further information by contacting: IARN, 1 Long Point Road, Belgrade Lakes, Maine 04918, USA. Tel. (207) 495-2215;

Calendar for November

1—National Day, Algeria, Antigua (24th for Zaire, 28th for Mauritania, 30th for Barbados and Benin)
3—Culture Day, Japan; Independence Day, Panama (18th for Morocco, 21st for Somali Democratic Republic, 22nd for Lebanon, 24th for Zambia, 25th for Suriname, 28th for Albania)
4—Flag Day, Panama
5—First Cry for Independence, El Salvador
6—Green March Day, Morocco
7—Election Day, USA; October Revolution Day, USSR
8—Queen's Birthday, Nepal
11—Veterans Day, USA; Armistice, France; Remembrance Day, Canada (12th for Bermuda, 13th for Great Britain
14—Dynasty Day, Belgium
15—Proclamation of the Republic, Brazil (29th for Yugoslavia)
17—Army Day, Zaire
18—National Holiday, Oman
19—Day of National Mourning, Germany; Latin American Week begins
20—Revolution Day, Mexico
22—Day of Prayer and Repentance, Germany
23—Thanksgiving Day, USA; Labor Thanksgiving Day, Japan
30—St. Andrew's Day, Scotland

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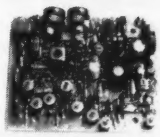

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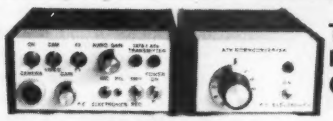

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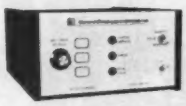

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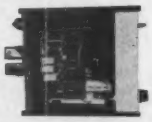

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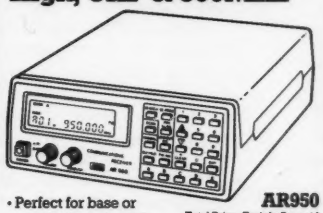

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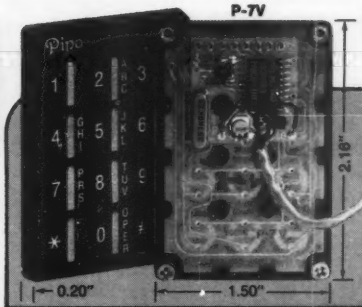

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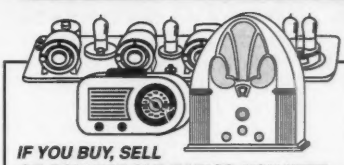

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Photo A. World Lithuanian Amateur Radio Net.

Photo B. Lithuanian Flag and Olympic Emblem.

FAX (207) 495-2069; 14.275 and 21.275 MHz.

Paul Pauliukonis KB1TY provided us with information on the International Lithuanian Amateur Radio Net.

The International Lithuanian Amateur Radio Net meets weekends on 21.330 MHz at 1500 GMT or 1800 GMT, depending on propagation. When the 10 meter band to Northern Europe is open, the net then meets weekends on 28.444 MHz at 1400–1500 GMT.

The purpose of the net is to provide an opportunity for radio amateurs of Lithuanian descent the world over to meet each other, to rag-chew, and to practice speaking the Lithuanian language.

Currently the net has about 80 members, with a good 15–20 participating in the weekend operations. Net coordinator is UP1BZZ (Northern Lithuanian Group which placed second in the 1988 CQ WW Contest), assistant coordinators are N8AUM, N6SFD, and G4BYW. KB1TY is the secretary.

Historic Lithuanian Sailboat Crossing of the Atlantic Ocean

The International Lithuanian Amateur Radio Net, founded a year ago, volunteered to serve as a message transfer center between three sailboats and shore stations during the former's crossing of the Atlantic Ocean.

Three Lithuanian yachts, *Audra*, *Daile*, and *Lietuva*, flying the tricolor flag of Lithuania, set sail from Klaipeda, Lithuania, for New York on May 13, 1989, to commemorate the tragic transatlantic flight of the American-Lithuanian Heros, Darius and Girenas. In 1933, the two pilots attempted to make a nonstop flight from New York to Kaunas, Lithuania. After successfully crossing the Atlantic, they later crashed in eastern Germany only several hundred miles from their destination.

The three yachts successfully crossed the Atlantic and arrived in Atlantic Highlands, New Jersey, on June 19–21. From there they were triumphantly escorted to New York's South Street Port on June 24. During the entire crossing, the Net, composed of amateur radio operators in Lithuania and in the United States, as well as in Bolivia, Israel, and England, maintained an almost daily contact with the boats, relaying messages and information. Contact was lost only during several days of very poor propagation.

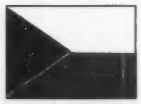
The following amateurs and club stations participated and contributed much time and effort to make this undertaking a huge success: 4Z4KX, CP8AL, G4BYW, W1HNF, WA1JZS, KB1PI, KB1TY, K2SRK, K3JA, W3POA, K3STM, N8AUM, KA9PVD, W9QVE, UP1BZO, UP1BWW, UP1BZZ, UP2BKX, UP2BH, UP2BR, UP2BLX, UP2BBZ, UP2CS, UP2BO, UP2BTE, UP3BH, UP3BK and UP3BM.

Photos A and B show a pennant printed in Lithuania by UP1BZZ and distributed to participants of the net. The front side contains the coat-of-arms of Lithuania with the inscription, in Lithuanian, "World Lithuanian Amateur Radio Net." The reverse side has the Lithuanian flag, a shield with the Lithuanian Olympics emblem, and the words "Lithuanians we are born, Lithuanians we should remain." Interestingly enough, anyone caught distributing these national symbols a year ago would have been jailed. Now they are freely allowed to print them.

For more information on the organization, write Paul Pauliukonis KB1TY, PO Box 321, Strafford NH 03884, USA.

[*More evidence of the worldwide openness continuing.*

—C.C.C.]



CZECHOSLOVAKIA

Rudolf Karaba OK3PC
Gogol'ova 1882
955 01 Topol'cany
Czechoslovakia

Rudy reports the results of the OK-DX Contest 1988. The winners of the single operator categories are: All Band UA1DZ, 1.8 MHz UC2OM, 3.5 MHz LZ1BB, 7 MHz LZ1NK, 14 MHz YU1KQ, 21 MHz UB5IJG, 28 MHz OK3CBU. The winner of the Multi Operator All Band category is 3W8CW.

The 1989 OK-DX Contest is the first weekend in November 1989.

SOUTH AFRICA

Peter Strauss
PO Box 35461
Northcliff 2115
South Africa

Johannesburg. The delegates attending the annual general meeting of the South African Radio League voted with an overwhelming majority for the Headquarters of the SARL to be moved from picturesque Cape Town to the business centre around Johannesburg. One of the major considerations was the lack of voluntary manpower to adequately manage the affairs of the 2500 members in the Republic. The general feeling of the delegates, who voted for the move, was that with most amateurs situated in the Johannesburg/Pretoria area, better regional representation could be implemented without any serious cost increases.

The League owns a small building in Cape Town accommodating the Book Shop, QSL bureau, and SARL Headquarters administration.

To move the Headquarters 1000 miles is not an easy task. To meet the deadlines and continue to provide members with continuity of service, the delegates appointed an interim management committee. The original three-member ber team was enlarged and managed the League affairs until the results of a national postal election were declared on 17 June 1989.

During its inaugural meeting held at the Johannesburg Amateur Radio Center (JARC), office bearers were elected, and they made a number of far-reaching decisions.

In the past, South African Radio Amateurs had to paste a QSL sticker on all outgoing cards. These stickers had to be bought from the League or the local Branch at a cost of about US $0.02 each. The trouble to obtain the stickers, even though the amateur was a member and still "had to pay to QSL," caused many amateurs to fail to QSL via the bureau. Nonmembers foiled the system by getting stickers from members.

A new QSL system was one of the first "hot potato" decision taken by the new team in Johannesburg. With immediate effect, no QSL stickers will be required for members. All outgoing cards will be checked against membership records. Nonmembers receiving or dispatching cards will have these returned.

For sorting QSL cards, an innovative solution was presented to the newly elected SARL Councillors and accepted: "The Bureau is now run by a group of handicapped people known as the 'Young Adult Learning and Earning,' YALE, under the supervision of Len Silberman ZS6BYE and an occupational therapist. While the cost of this service is considerably less than the employment of QSL Bureau staff, the SARL is also making a worthwhile contribution to the YALE project. "The first batches of cards have already been mailed," Hans v.d. Groenendaal ZS6AKV told our reporter.

Novice License for South Africa Soon? With attention given in the USA to the no-code license, South African radio amateurs are focusing their attention on the creation of a Novice Li-

cence. Presently, South Africa features a full CEPT class I compatible license, callsign prefix ZS, and a restricted license. The restricted license, compatible with the CEPT class II, permits operation on frequencies above 30 MHz. The technical exam is identical for both license classes, but the ZS license requires code at 12 wpm.

Considerable thought has been given to the creation of a license to encourage young people of **all races** to pass the radio amateur exam (RAE). The minimum entrance level, similar to US General/Advanced class theory, was considered a problem for young beginners. The bursaries offered by the South African Amateur Radio Trust have helped to increase the profile of the amateur radio service among young people in South Africa.

Once a proposal, based on the experience in other countries with Novice licenses and local conditions, has been formulated, the introduction of such a license is not expected to take long.

Fund-Raising Scheme Attracts Contributors. Recently, the Johannesburg Branch of the SARL launched a fund-raising scheme—the Johannesburg Branch 500 Club. Membership is easy; you just make a one-time contribution of Rand 500 (US $200) to the fund. Members receive a handsome certificate in recognition of their donation. The funds are being used to help finance the move of the national offices to Johannesburg, and for the purchase of essential office equipment, including a FAX machine. Contributions should be sent to SARL 500 Club, PO Box 13754, Northmead, 1511 South Africa.

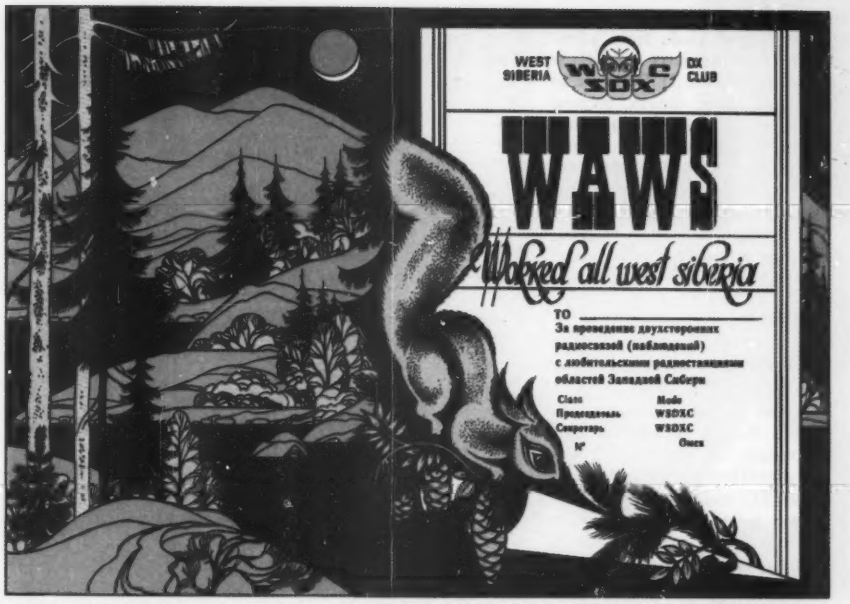


Photo C. WAWS Worked All West Siberia Award from the West Siberia DX Club, sent by UA9MA. Again loosely translated by Bryan NS1B: "(To the award recipient) for successful two-way contacts (observed) with amateur radio stations in the oblasts of Western Siberia."

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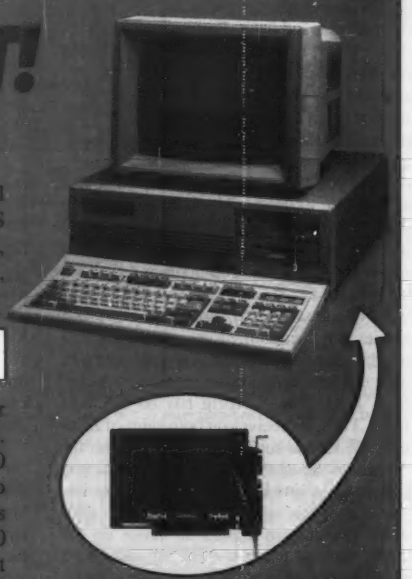

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CIRCLE 239 ON READER SERVICE CARD

Continued from page 13

The key is made from a microswitch with a lever arm. If you prefer, any key will do. Don't use an electronic keyer, though, because all the current for the transmitter passes through the key! In any event, keep the key wires under one foot long for best results. It's probably not a good idea to mount the key on the radio cabinet, because the vibration produced from pounding on it may cause chirp or drift.

Tuning Up

Tune-up is very easy. First, mount the rig in its cabinet. Now, install the batteries, set the T/R switch to receive, and connect an antenna. Turn on the power and set the volume up about two-thirds. You should hear some hiss or noise. Set the RIT tuning cap (TC5) to its midway point. Set the main tuning cap to its fully meshed position (counterclockwise, when viewed from the front of the radio). Use your other HF rig in the CW mode to transmit a 3.695 MHz carrier, at the lowest possible power level, into the dummy load. Referring to Figure 1, adjust TC1 until you hear the carrier tone. Adjust IFT1 and IFT2 for the loudest tone. Now, stop transmitting.

Set the main tuning cap to the midway point. Carefully remove some of the wax holding the antenna coil to its rod, so that you can slide the coil back and forth. Pull it out so that it is just hanging on the end of the rod. With the plastic end of a screwdriver, slowly push it onto the rod and listen for signal and/or noise peaks. The first one is the undesired image frequency, and the next one is the one you want. You'll hear the static and signals rise dramatically. It's a pretty steep peak, and it may take more than one try to get it just right. When you've got it, use a daub of nail polish to hold the coil in place.

Now, set the main tuning cap fully clockwise. Use the HF rig to transmit a 3.755 MHz carrier into the dummy load, and adjust TC3 (on the back of the main tuning cap) until you hear the tone at about the same pitch as before. Note: The Flavorig has no sideband filter. Thus, it receives on both sides of zero-beat. Be sure to set TC3 so that you hear the carrier on the same side of zero-beat as you did when adjusting TC1. At this point, you may wish to readjust IFT1 and IFT2 while listening to signals or noise on the band, without using the HF rig, to obtain maximum sensitivity. This completes receiver alignment.

To align the transmitter, return the HF rig to receive, reconnect it to the antenna, and set it to 3.720 MHz. Connect the Flavorig to the dummy load or a 47Ω resistor, and set the T/R switch to transmit. Do NOT key the rig. Adjust TC2 until you hear the Flavorig's oscillator on the HF rig. Now, set L2 to the middle of its range. Key the rig and adjust L2 for maximum output as observed on the HF rig's S-meter. You may have to retune the HF rig slightly, as the Flavorig's oscillator shifts a tiny bit when keyed.

If you hear a loud rushing noise from the Flavorig's speaker, check the phase of the connections to L2; you may have reversed one. If the HF rig's S-meter is pegged, disconnect its antenna or switch in the RF attenuator to reduce the reading.

Now, use the HF rig to transmit a CW carrier on 3.695 MHz, and tune it in on the Flavorig (set to receive, of course), on the high side (clockwise) of zero beat. Set the HF rig to receive, and the Flavorig to transmit. Key the rig and adjust TC2 until you hear the tone on the HF rig. Then, set the HF rig to 3.755 MHz, and repeat the procedure, this time adjusting TC4 (on the back of the main tuning cap).

This completes the alignment of the Flavorig. The total tuning range is 3.695 to 3.755 MHz, covering 5 kHz on each side of the Novice segment. If you're a Novice or Tech, be careful when transmitting near the band edges!

Parts List

Part	Type	Source and No.
Flavoradio		RS 12-201, 12-202, 12-203
Q1, Q7	MPF-102	RS 276-2062
Q6	M3819	RS 276-2035
Q9	BS170	Digi-Key BS170
Q10	2N2222A	RS 276-2009
Q11	IRF511	RS 276-2072
U1	TLC555	RS 276-1718
D4	1N914	RS 276-1122
D5	6.1 V zener	RS 276-561
X1	455 kHz	Digi-Key P9942
L3, L5	T50-2	Radiokit
L4	100 µH	RS 273-102
L6	10 mH	Digi-Key M7100
TC1, TC2	6-50 pF	RS 272-1340
TC5	0-365 pF	RS 272-1337
S2	3PDT	Digi-Key SW121-ND
Heatsink	TO220	RS 276-1363
C123	10 mF	
C101, C116, C117, C122, C124	0.1 mF	RS 272-109 (5 in pack)
C102, C103, C115	0.01 mF	
C104, C105, C118, C121	0.001 mF	
C108, C120	220 pF	
C111, C125	100 pF	
C109	47 pF	
All 33 pF and lower caps are from the RS 272-806 assortment:		
C106	5 pF	
C107	18 pF	
C110	10 pF	
C112	33 pF	
C113	3 pF	
C114	2 pF	
R101, R102	1k	
R103, R114	10k	
R104, R107, R115	1 Meg	
R105, R109	220	
R106	47k	
R108, R112	100	
R110, R111	470	
R113	100k	

Sources: Digi-Key Corporation, 701 Brooks Ave. South, PO Box 677, Thief River Falls MN 56701-0677. (800) 344-4539. Radiokit, PO Box 973, Pelham NH 03076. (603) 635-2235.

Notes

Those familiar with radio design may find the Flavorig a bit odd. For instance, there is no electrical coupling between the oscillator and Q1, the receive RF amp, and no explicit mixer. Coupling is performed by the proximity of the oscillator to the antenna coil. This method produces the simplest, most sensitive receiver, and also eliminates oscillator pulling on strong signals.

Also, the wire coupling wound around the antenna coil has no ground connection. There's more than enough coupling as it is. And there's no tuning cap across the antenna coil. The FET's internal capacitance, and the coil's own distributed capacitance, resonate the coil nicely on the 80 meter band, with sufficient bandwidth to cover the Novice segment without further tuning.

Tracking of the TX and RX frequencies across the band is much more difficult to achieve in a superhet than it is in a direct conversion receiver. Careful alignment of TC1, TC2, TC3, and TC4 will result in fairly good tracking, but it may vary by a few hundred Hertz from edge to edge. Fortunately, you can use the RIT control to compensate, should it become a problem.

The VFO is very stable after about a 10 minute warmup. If you hear significant drift or instability, check that all wires from the oscillator coil and going to the T/R switch are kept short and held rigid.

The final transmit amp uses a power FET. It is very stable with all but the most extreme SWR. At 13.8 volts, output will be about 5 watts. At 12 volts, 3.5 watts. And at 10 volts, a still-respectable 1.5 watts!

When using a longwire antenna with a tuner, be sure to ground the rig, or it may become hot with RF. (Yes, 5 watts can hurt!) Also, avoid long keydown periods, as the transistor can overheat. The heatsink will get warm in normal operation, but should not get burning hot. If it does, consider a larger heatsink.

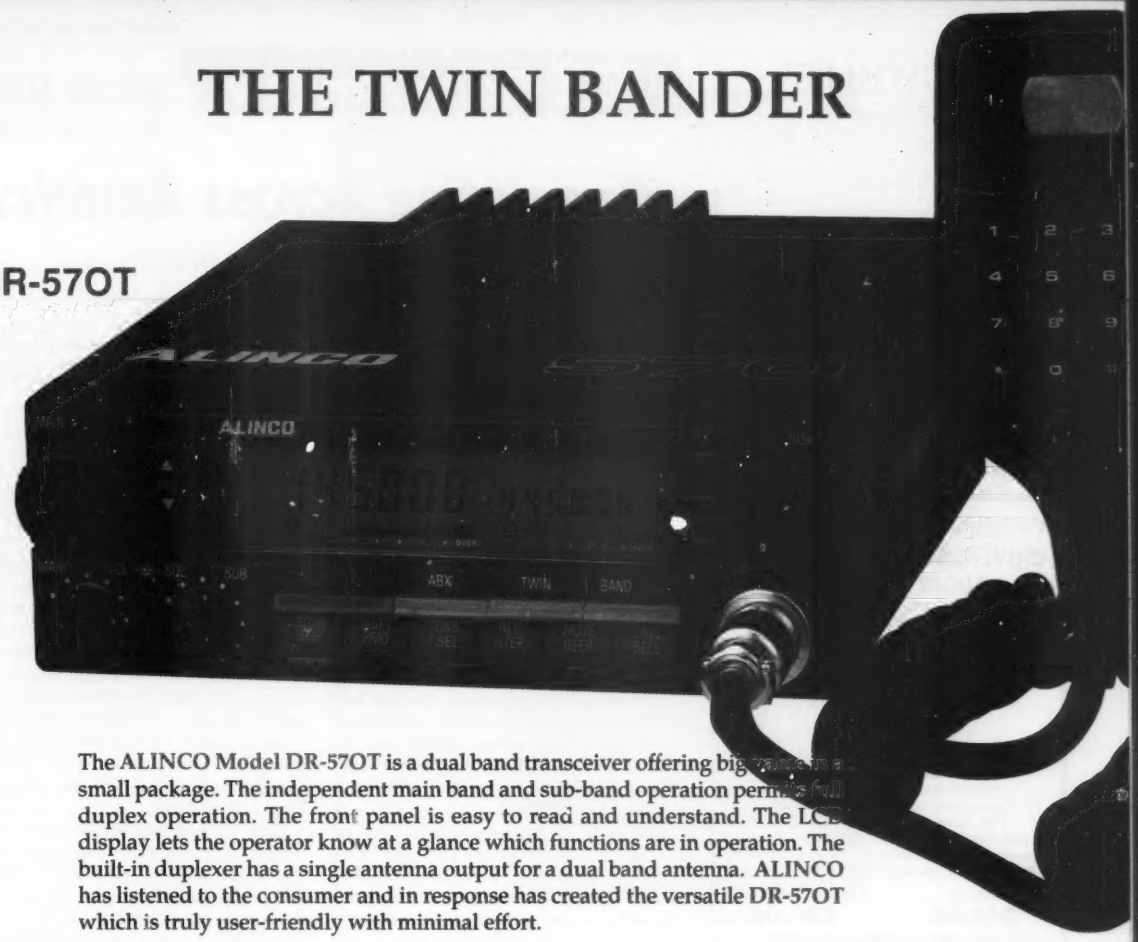
Conclusion

Enjoy your Flavorig. For such a simple beast, it works remarkably well. Once you make a contact on a rig you built yourself, you may find that '940 gathering dust while you experience the thrill of pounding out your call on a 5 watt box! 73

Michael Geier KB1UM writes the "Ask Kaboom" column. You can reach him at 7 Simpson Court, S. Burlington VT 05403.

THE TWIN BANDER

DR-57OT



The ALINCO Model DR-57OT is a dual band transceiver offering big [illegible] in a small package. The independent main band and sub-band operation permits full duplex operation. The front panel is easy to read and understand. The LCD display lets the operator know at a glance which functions are in operation. The built-in duplexer has a single antenna output for a dual band antenna. ALINCO has listened to the consumer and in response has created the versatile DR-57OT which is truly user-friendly with minimal effort.

- *ULTRA-COMPACT BODY*
  5 7/8" (W) x 2" (H) x 8 1/2" (D)
- *HIGH POWER*
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  Approximately 5 watts low power.
- *EXTENDED RECEIVER RANGE*
  (130-169.995 MHz) on 2M, 144-147.995 MHz transmit. 440-449.995 MHz on 70 cm. (transmit and receive)
  (Specifications guaranteed on amateur bands only. Modifiable for MARS/CAP permits required)
- *SIMULTANEOUS*
  Receiving on both bands at the same time
  Scanning: intermix scan modes on both bands at the same time
- *INDEPENDENT*
  The volume, squelch and control dial are independently adjustable on both bands. You can store the following information on both bands at the same time. Priority function, choice of 37 encoding/decoding sub-tone frequencies,call channel, scan function (program, memory channel, VFO or unique open channel scan), memory skip, bell function, + or - repeater shift.

FULL FEATURES

- *FULL DUPLEX CROSS BAND OPERATION*
  Transmit on one band while receiving on the other band -- telephone style.
- *AUTOMATIC BAND EXCHANGE (A.B.X.)*
  When in the ABX function is active, an incoming signal on the sub-band will activate an automatic exchange between the main band and the sub-band.
- *PRIORITY*
  The VFO frequency is monitored for 5 seconds and then shifts for one second to the selected priority channel (In both bands at the same time).
- *DUAL SPLIT SHIFT OPERATION*
  Operates odd offset operation
- *BELL FUNCTION*
- *REPEATER REVERSE FUNCTION*
- *CALL CHANNEL FUNCTION*
- *BEEP FUNCTION*
- *20 MEMORIES (10 FOR EACH BAND)*
  Each memory channel can store frequency, repeater offset, encode/decode frequency.
- *4 SCANNING MODES*
  Program scan, memory scan, band scan and unique open channel scan (opposite to normal busy scan). Scan stops on a busy (or open channel) channel andthen resumes approximately 5 seconds after stopping even if the signal is still present.
- *REPEATER OPERATION*
  The DR-57OT can be used as a cross band repeater.

EASY TO OPERATE FUNCTION

- *LARGE AMBER MULTI-FUNCTION LCD DISPLAY*
  Visible in all conditions, it indicates main and sub-band frequencies, frequency step, "on air", "call", "CTCSS", "PRI", "REV", "-", "+", "•", " T" (tone), tone frequency, "MUTE", "LOCK", "ABX", "♪", "BUSY", "F", "S/RF meter", "REV"
- *MHz FUNCTION FOR BOTH BANDS*
  One MHz is increased or decreased per touch
- *SELECTABLE DUAL AND SINGLE BAND OPERATIONS*
  One touch selection with pressing of twin key
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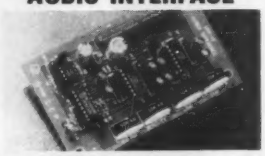

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73 Book Review

Reviewed by Alida M. Jatich KA9KAG

Computing Across America

A view of Steven K. Roberts N4RVE's book.

"Suburbia is not a place; it's a state of mind . . . You live in suburbia when the cycle of work and play becomes dangerously unbalanced in favor of work." (*Computing Across America*, page 3.)

If you're like me, there have been times when you've felt that your lifestyle is too confining. Do you spend so much time maintaining your home, your car, and other possessions that it seems those possessions own you? Does your work really offer you excitement, creativity, contact with other people, and a sense of adventure?

Or do you just wear yourself out, go home, eat supper, do chores, and fall asleep in front of the TV? This world is full of colorful places and fascinating people. Do you feel you have to wait until you retire to see them for yourself? If you've ever had the impulse to sell your house and car, quit your job, and travel for the next few years, then you'll probably enjoy this book.

Readers of *73 Magazine* will be familiar with Steve Roberts' articles about the technical aspects of his tour of the United States. Roberts' recumbent bicycle carries a cornucopia of ham gear, computers, and modems, together with a stereo, a TV, and other goodies, powered by two banks of solar cells and protected by a sophisticated alarm system. The current version of his bicycle even contains an eight-switch ASCII keyboard embedded in the handlebars. Roberts can actually enter characters into his computer while pedaling the bicycle, which helps him continue to earn a living as a writer while on the road.

This book does not contain circuit diagrams and technical discussions of Roberts' gear. For that, keep watching the pages of *73 Magazine*. Rather, it is the story of Roberts' adventures: the people he met and the places he saw on his first trip.

Roberts seems to be something of a romantic soul. This book was written almost from a poet's point of view. He acquired so many girlfriends on his first journey that the book could almost have been called "Womanizing Across America." Roberts recalls each of these relationships in a gentlemanly and gallant way. OMs may enjoy fantasizing about such exploits, but as a YL, I was somewhat taken aback at the number of broken hearts he left behind. But he wasn't ready to settle down. The call of the open road, which he calls "the other woman," proved too strong a lure.

On his journey, Roberts encounters the conflicts between security and freedom, comfort and adventure, and the desire for permanent relationships and the reluctance to give up future options. He acutely observes the lifestyles and customs prevalent in the places he visits. Some passages are moving, such as his first meeting with his biological mother. Some are informative, such as his tour of the National Weather Service station in Louisiana, and his description of how he used the Compuserve online network. Others are humorous, such as an unexpected encounter with a rattlesnake in New Mexico.

My own decision to buy this book was influenced by the fact that I had also enjoyed two other books of this genre, *A Walk Across America* by Peter Jenkins, and *Blue Highways*, by William Least Heat Moon. These books cover similar territory, both literally and figuratively—traveling through America as an adventure, an education, and a rite of passage. Roberts even stayed in Lake City, Colorado, which had been made famous in Peter Jenkins' book.

Like Jenkins and Least Heat Moon, Roberts acquires more confidence on his journey and takes the opportunity to rid himself of stereotypes, prejudices, and fears. Since Roberts' personality and outlook differs so much from that of the other two authors, *Computing Across America* presents an original point of view. Roberts appears to have somewhat more of an ego than the other two authors. He is also more outgoing. He actively seeks emotional involvement, attention, and the limelight. He also appreciates the possibilities of using technology in the service of greater freedom.

Steve Roberts is still traveling and writing, but now he has a traveling companion, Maggie Victor KA8ZYW. (She appears in the epilogue of *Computing Across America*.) This book mentions their getting ham licenses, but doesn't say much else about ham radio. A book such as this wouldn't be the place to discuss the technical aspects of ham radio, but ham radio isn't just equipment and technology. It's also communication—meeting, getting to know, and working with other people. In future books, I hope that he and Maggie share some ham radio stories with us.

I recommend this book. Where do you buy it? If you missed the opportunity to buy an autographed copy from the author at the Dayton Hamvention, you can order it by mail from *Computing Across America Publications Center, PO Box 2390, Santa Cruz CA 95063*. Softcover, $9.95 and hardcover, $15.95. Add $2 postage and handling per order. 73

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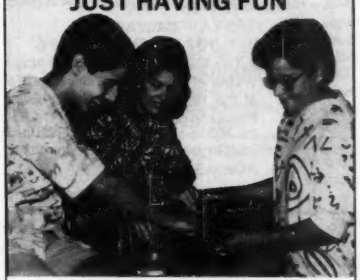

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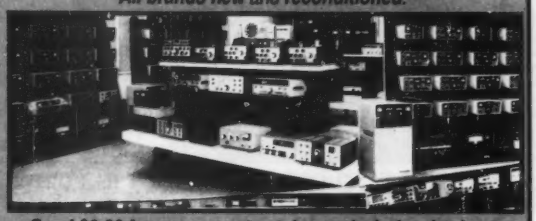

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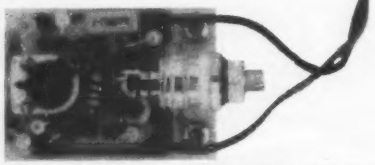

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SPECIAL EVENTS

Ham Doings Around the World

SOUTHFIELD MI
NOV 5

The Oak Park ARC presents its annual Swap-N-Shop at the Southfield Pavillion Center. Free parking. Admission $4 each. Kids under 12 free. 8-ft. tables $10 each. Reservations required. Allow 2 weeks to process reservations. Send payment to *Oak Park ARC, Inc., PO Box 1422, Royal Oak MI 48068.*

SUMTER SC
NOV 11

The Sumter ARC will sponser a late fall hamfest at the Sumter County Exhibition Center. 20,000 sq. ft. indoor flea market, handicap access. Advance tickets $4, door $5. Talk-in on 147.015. Contact *SARA, P.O. Box 193, Sumter SC 29151-0193* or *Ted Kreipe KB4FIQ, (803) 773-5189.*

NORTH HAVEN CT
NOV 12

The South Central Connecticut ARA will sponsor their tenth Annual Flea Market at North Haven Park and Recreation Center. Sellers 7 AM, Public 9 AM–3 PM. Wheelchair accessible. Admission $3, advance tables $12, door $15. Table reservations with a check must be received by Nov. 2. No reservations by phone. Talk-in: 146.01/.61/.61. Send SASE to *SCARA Flea Market, PO Box 81, North Haven CT 06473* or telephone *Brad Oestreicher WA1TAS, (203) 265-6478, 7–10 PM.*

ROCKFORD IL
NOV 12

Rockford ARA & Experimental ARA will sponsor Rockford Hamfest—'89/ Computer Fair at the Forest Hills Lodge. Commercial exhibits and flea market inside, tailgating outside. Advance tickets $3, door $4. Tables $7 advance, $10 at door. For booths and tables call *Lonnie Miller (815) 623-7576.* For general information call *Paul Klein (815) 226-4696.* Send SASE for reservations/tickets to *Rockford Hamfest, P.O. Box 10003, Rockford IL 61131.*

HANNOVER GERMANY
NOV 11–12

The 8th Ham-fair INTERRADIO, sponsored by the Ten-Tec Amateur Radio Equipment Owners Group (TTOG), will be at the Hannover exhibition grounds, to found a special interest group for Ten-Tec equipment owners. TTOG is totally independent of Ten-Tec Inc. in Tennessee, USA. For more information send an SASE and 2 IRCs to *TTOG Jurgen K. Jagelle, DF 9 Ai, Garkenburgstrasse 52, D-3000 Hannover 81, Federal Republic of Germany.*

FORT WAYNE IN
NOV 12

The Allen County Amateur Radio Tech. Society will sponsor the 17th annual Fort Wayne Hamfest at the new Allen County War Memorial Coliseum Exposition Center starting at 8 AM. Tickets are $3.50 advance, $4 at the door. Parking $1. Talk-in on the 146.88 (-) and 443.80 (+) repeaters. Standard tables $12., premium tables $25. AC power extra. For more info write *AC-ARTS, PO Box 10342, Fort Wayne IN 46851.*

SINGAPORE
NOV 17–19

The 17th Southeast Asia Network Convention (SEANET 89), held in Singapore, includes demo of new technology-interactive communication system "TELEVIEW". Contact *Organizing Committee, SEANET '89, Maxwell Road PO Box 2728, Singapore 9047.*

TAMPA FL
NOV 18–19

The Annual Suncoast Convention, sponsored by the Florida Gulf Coast Amateur Radio Council, will be held at Curtis Hixon Convention Center. Inquire about booth spaces, swap tables and convention rooms as soon as possible by calling *(813) 442-3830 afternoons.*

WASHINGTON PA
NOV 19

The Washington Amateur Communications Club will hold its 2nd Annual Tri-State hamfest indoors at The Meadows from 8 AM–3 PM. Admission $1, children under 12 free. Talk-in: 145.49/ W3CYO-Rptr. and 146.52. Contact *Carl Stark KD3KH (412) 225-5684 or Jim Mounts KA3EBX (412) 941-2670.*

NORTH OLMSTED OH
NOV 26

The North Coast ARC is holding its Swapfest at the North Olmsted Community Cabin from 9 AM to 2 PM. Talk-in on the 145.29 and 224.84 repeaters. Contact *Chuck Early K8RSH (216) 777-1595.*

SPECIAL EVENTS STATIONS

CALVARY GA
NOV 4 (Rain Day NOV 11)

The Albany ARC will operate station W4MM at 1200Z–2400Z in celebration of the 18th Annual Mule Day Event. Frequencies: 3.975, 7.245, 14.250, 28.383. For Certificate send large SASE to *AARC, Inc., PO Box 70601, Albany GA 31705.*

CLAREMORE OK
NOV 4–5

Rogers County Wireless Assoc. will operate N5OK from the Will Rogers Memorial, 1300Z–2300Z. Frequencies: lower 15 kHz of the general band on 20 and 15 meters, and 28.430. Send QSL and SASE to *RCWA, Rt. 3, Box 793, Claremore OK 74017.*

BUTTE MT
NOV 6–12

The Butte ARC will operate W7FO to celebrate the 100th brithday of Montana's statehood. Frequencies: 3.890, 7.280, 14.280, 21.370, and 28.470. For certificate send 9 x 12 SASE to *Butte ARC, PO Box 4036, Butte MT 59701.*

NOV 11–12

The Montana Centennial QSO Party is being sponsored by the Butte ARC from 0000Z–2400Z. 10–80 meters phone and CW. Frequencies: PHONE—3.890 7.280 14.280 21.370 28.470; CW-40 kHz from low end; NOVICE—25 kHz from low end. Framable certificate to highest scorer in each state. Mail logs (to be received by Dec. 12) and legal size SASE to *W7FO Butte ARC, PO Box 4036, Butte MT 59701.*

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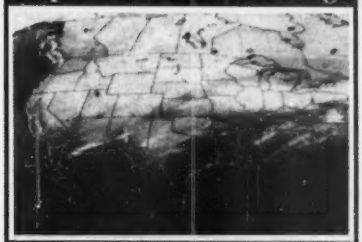

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
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Payson AZ 85541

It looks as if the best week of the whole month will be from the 18th to the 25th. The second and third weeks of the month are expected to be fair to poor, and the first and last weeks will probably average fair.

Solar flux and sunspot activity increase rapidly these days, and solar events, such as flares, are commonplace. Ionospheric upsets and magnetic storms become the rule rather than the exception.

All this activity means that events change rapidly, and propagation conditions can be quite good one day and quite poor the next.

For best results, monitor WWV at 18 minutes after each hour. Boulder "K" index values, changing up or down, give trends during each day, while Planetary "A" index values give day-to-day changes. Decreasing "K" and "A" indexes mean a quiet(er) magnetic field, while increasing indexes mean a more active one.

Use the Overall Band/Time chart for predicting the possibility of band openings to various parts of the world at different times—and then use your daily forecast to see if there is a good likelihood that those possible openings may, in fact, be usable. In the "best band to use" chart, the following parenthetical notes apply: (1) try 40 or 30 meters; (2) try 15 or 18 meters; (3) try 10 or 12 meters; (*) try 80 meters. With WARC bands active, you may use 30 and 40 together; 10 and 12 together; and 17 and 20 together for openings shown on the chart. ■

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15*	20	20	20	—	—	—	—	—	—	—	15*
ARGENTINA	15	15	20	20	40	—	—	10	—	—	10	10
AUSTRALIA	10	15	20	20	—	40	20	20	—	—	—	10
CANAL ZONE	15	40*	40*	40*	40*	—	20	10	10	10	10	10
ENGLAND	20	40	40	40	—	—	20	10	10	10	15	20
HAWAII	10	15	20	20	40*	40	20	20	—	—	—	10
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	15*	20	20	20	—	—	—	—	—	—	—	15*
MEXICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
PHILIPPINES	—	—	20	20	—	—	20	15*	15*	—	—	—
PUERTO RICO	15	40*	40*	40*	40*	—	20	10	10	10	10	10
SOUTH AFRICA	40*	20	20	20	—	—	—	—	10	10	10	15
U.S.S.R.	—	40	20	20	20	—	—	10	10	15	20	20
WEST COAST	10	15	20	20	3/40	3/40	—	—	—	10	10	10

CENTRAL UNITED STATES TO:

ALASKA	10	15	20	20	20	—	—	—	—	—	—	—
ARGENTINA	15	15	20	20	20	—	—	10	—	—	10	10
AUSTRALIA	10	15	15	20	20	40*	40	20	—	—	15	10
CANAL ZONE	15	15	20	20	—	40	40	10	10	10	10	10
ENGLAND	—	—	—	—	—	—	10	10	15	15	20	20
HAWAII	15	15	20	20	40*	40*	40	20	—	—	10	10
INDIA	—	20	—	—	—	—	—	20*	15	—	—	—
JAPAN	10	15	20	20	20	—	—	—	—	—	—	—
MEXICO	15	15	20	20	—	40	40	10	10	10	10	10
PHILIPPINES	15	—	—	—	—	—	—	20	10	10	—	—
PUERTO RICO	15	15	20	20	—	40	40	10	10	10	10	10
SOUTH AFRICA	20	20	20	—	—	—	—	—	10	10	15*	15
U.S.S.R.	—	—	20	—	—	—	20	15	15	15	20	20

WESTERN UNITED STATES TO:

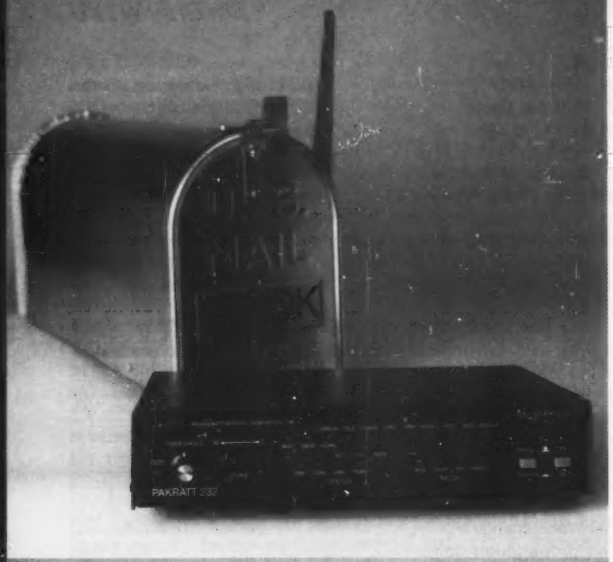
ALASKA	10	15*	—	20	20	20	20	20	20	20	—	15
ARGENTINA	10	15	15	20	20	20	—	—	10	—	10	10
AUSTRALIA	10	15*	15*	20*	20	20	40	—	—	—	—	10
CANAL ZONE	10	15	15	3/40	3/40	—	—	—	15*	10	10	10
ENGLAND	—	—	—	—	—	—	—	—	15	20	15	—
HAWAII	10	10	15	20	40*	40*	40	40	15	15	—	15
INDIA	—	3/40	—	—	—	—	—	—	3/40	15*	—	—
JAPAN	10	15*	—	20	20	20	20	20	20	20	—	15
MEXICO	10	15	15	3/40	3/40	—	—	—	15*	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	—	20*	15	15	—
PUERTO RICO	10	15	15	3/40	3/40	—	—	—	15*	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	—	—	—	20	20	—	—	—	15	15	20	20
EAST COAST	10	15	20	20	3/40	3/40	—	—	—	10	10	10

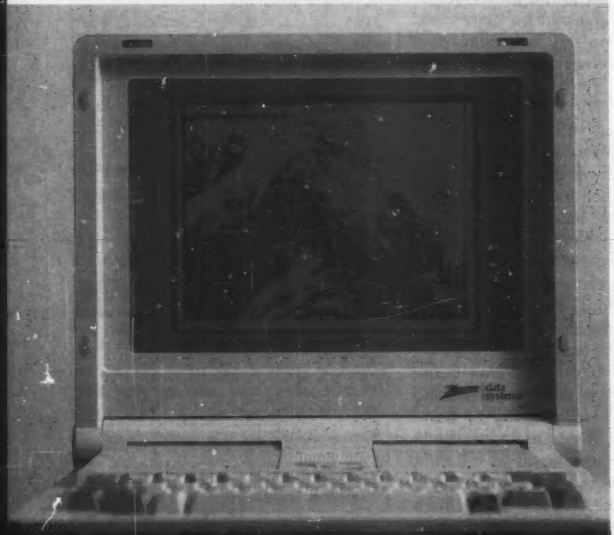
* Try next higher band (1) Difficult path

NOVEMBER 1989

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F	3 F-G	4 G
5 G	6 G-F	7 F-P	8 P	9 P	10 P-F	11 F
12 F-P	13 P	14 P	15 P	16 P-F	17 F-G	18 G
19 G	20 G	21 G	22 G	23 G	24 G	25 G-F
26 F-P	27 P	28 P-F	29 F	30 F-G		

AEA's NEW PK-232MBX With PakMail™





Now AEA's popular PK-232MBX multi-mode data controller has all of the features you've been asking for...PakMail™ mailbox with third-party traffic, seven-character AMTOR sel-call, TDM (Time Division Multiplexing) Rx for SWL and priority acknowledgment features. Compatible with almost every computer or data terminal, you can enjoy the full spectrum of digital communications with the PK-232MBX.

All Operational Modes. The PK-232MBX includes all of the **recognized** data modes available today... AMTOR, ASCII, Baudot, CW, FAX Tx and Rx, NAVTEX marine and packet.

Modem Superiority. An eight-pole chebyshev bandpass filter limiter-discriminator modem enhances the signal-to-noise ratio at the detector and virtually eliminates interference from adjacent signals. This system is superior to PLL modem technology which was designed for minimal noise interference.

PakMail.™ PakMail™ mailbox with third-party traffic is now a standard feature. Leave and retrieve packet messages around the clock. The PakMail™ plug-in board/update is compatible with all PK-232's. Contact factory for details. The upgrade also includes TDM (Time Division Multiplexing) decoding and seven-character AMTOR sel-call. Priority acknowledgment is also included to reduce packet collisions.

FAX Transmission. The **first** multi-mode TNC to transmit FAX, the PK-232/MBX supports the widest range of printers using the optional RS-232/printer cable.

Host Mode. Only AEA provides a fully functional Host Mode which enables programs to control the TNC more efficiently. Programs include PC-Pakratt with FAX for IBM PC and compatible computers, COM-Pakratt with FAX for the Commodore 64 and 128, and now MacRATT with FAX for the Macintosh.

Two Radio Ports. Independent radio connection ports allow interchangeable HF or VHF operation, selectable from the front panel for convenience.

Signal Anaylsis. The PK-232MBX internal software has the exclusive SIAM™ (Signal Identification and Aquisition Mode) feature which lets you tune an unidentified signal. The PK-232MBX can automatically determine the signal's mode, baud rate or speed and configuration.

You Deserve the Original. AEA was the first to produce a multi-mode TNC, and it still remains the standard by which all other TNC's are compared. Don't settle for less.

Advanced Electronic Applications, Inc.
2006-196th St. SW/P.O. Box 2160
Lynnwood, WA 98036
206-775-7373

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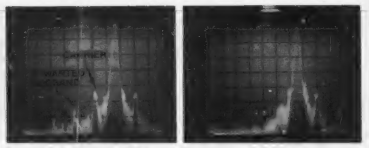

Without DSP | With DSP

TS-950SD

"DX-clusive" HF Transceiver

Transmit the ultimate signal.

The new TS-950SD is the first Amateur Radio transceiver to utilize Digital Signal Processing (DSP), a high voltage final amplifier, dual fluorescent tube digital display and digital meter with a peak-hold function.

• Digital Signal Processor. DSP is a state-of-the-art technique that maximizes your transmitted RF energy. Your signal stands out because it is much more pure than your competition! You can even tailor your transmitted CW or voice signal waveshape!

• Dual Frequency Receive Function. The TS-950SD can receive two frequencies simultaneously. The sub-receiver has independent controls for frequency step size, noise blanker, and AF gain and its own digital display!

• New! Digital AF filter. Synchronized with SSB IF slope tuning, the digital AF filter provides sharp characteristics for optimum filter response.

• New high voltage final amplifier. 50 V power transistors are used in the 150W final section, resulting in minimum distortion and higher efficiency. Full-power key-down time exceeds one hour.

• New! Built-in microprocessor controlled automatic antenna tuner. The new antenna tuner is faster and you can store the settings in memory! (Manual override is also possible.)

• Outstanding general coverage receiver performance and sensitivity. Kenwood's Dyna-Mix™ high sensitivity direct mixing system provides incredible performance from 100 kHz to 30 MHz. The Intermodulation dynamic range is 105 dB.

• *Multi-Drive Band Pass Filter* (BPF) circuitry. Fifteen band pass filters are available in the front end to enhance performance.

• High performance IF filters built-in. Select various filter combinations from the front panel. For CW: 250 and 500 Hz, 2.4 kHz for SSB, and 6 kHz for AM. Filter selections can be stored in memory!

• Kenwood interference reduction circuits. SSB Slope Tuning, CW VBT (Variable Bandwidth Tuning), CW AF tune, IF notch filter, dual- mode noise blanker with level control, 4-step RF attenuator (10, 20, or 30 dB), switchable AGC circuit, and all-mode squelch.

• Built-in TCXO for highest stability.

• Built-in electronic keyer circuit.

• 100 memory channels. Store independent transmit and receive frequencies, mode, filter data, auto-tuner data and CTCSS frequency.

• Digital bar meter.

Additional Features: • Built-in interface for computer control • Programmable tone encoder • Optional VS-2 voice synthesizer • Built-in heavy duty AC power supply and speaker • Adjustable VFO tuning torque • Multiple scanning functions • MC-43S hand microphone supplied

Optional Accessories: • VS-2 Voice synthesizer • SP-950 External speaker w/AF filter • SM-230 Station monitor w/pan display • SW-2100 SWR/power meter • TL-922A Linear amplifier (not for QSK)

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